DIFFERENCES IN ATTITUDINAL AND OTHER PSYCHOLOGIC TRAITS MANIFESTED BY SELECTED HIGH SCHOOL GIRLS IN RELATION TO CAREER CHOICES INVOLVING SCIENCE AND MATHEMATICS

A THESIS

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D E D I C A T I O N

TO

My husband, Daniel, and my two sons,

Paul and George

Whose constant encouragement has been

a real inspiration

A C K N O W L E D G E M E N T S

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M. G. G.

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CHAPTER I

INTRODUCTION

Rationale.--Public attention has been increasingly centered upon the manpower and womanpower shortage of scientists, mathematicians and engineers. Until the present century women had been chained to the kitchen and nursery and the only professions considered appropriate for them were teaching and nursing. The role of the modern woman has changed sharply. This "push button" age, brought about by science and inventions, has released women from domestic drudgery, freeing them to do exciting and interesting jobs. Why not careers in science?

Americans are brought up on the man-made theory that the scientific world is for men only, that women lack the physical stamina, the mental and mechanical aptitude and have no business in science anyway. In our society a career involving science and mathematics is regarded as somehow unfeminine. No one has yet shown that the male species is more intelligent, more sensitive, more imaginative, more observant, and more curious than the female. Psychologists find that girls consistently demonstrate superiority in verbal abilities, have better memories, quicker perception and much greater finger dexterity than boys. Although many girls possess the qualities suited for science careers, (patience, conscientiousness, meticulous neatness, a capacity for keen observation, attention to fine details, an adaptability to team work, native logic, and intuition),

relatively few make a choice of science as a career.[1] The Sputnik and Missile race affords a milieu for women to consider seriously careers in science although traditions and prejudices against them are still to be reckoned with. The ability of women has been demonstrated, the atmosphere is being cleared, and the United States faces the potential of partially overcoming a drastic shortage in scientific manpower and womanpower.

If interest could be aroused in the field of science at the high school level and girls encouraged to study the sciences, the United States might more nearly meet the many challenges of the "space age." The greatest obstacle in the way of education of women in scientific fields is the persistence of outmoded conceptions in the minds of young girls, their parents, educators, vocational counselors and even prospective employers. Some of these conceptions are: to study science is not womanly; that there is no cultural value in the study of the physical world in which we live; that the sciences are a male preserve; that there are really no good opportunities for women in scientific fields; and the notions that women get hysterical in a crisis, that they personalize business relationships, and that they are always on a honeymoon or in a maternity ward when needed. The inclinations of association of sexes and professions have their origin early in childhood and throughout the young girl's school life, she is motivated to steer clear of science subjects by her parents, her teachers and her conditioned interests.

Radcliff President Dr. Mary I. Bunting, in an article entitled "Our Greatest Waste of Talent Is Women," states that:

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[1]Philip Pollack, Careers and Opportunities in Science (New York: E. P. Dutton, Incorporated, 1960), p. 157.

> There are a tremendous number of women who are not doing something hard enough that they think is important enough. They are busy. They are exhausted. But they are not happy. We don't know if women scientists are as competent as men. They've simply never bothered to find out. But it doesn't matter. We need all kinds of people today, not just the physicist who send off the satelite. Of all the talented people who don't go to college today, the majority are women.[1]

It is believed that this research may provide some means of identifying talented girls who may choose careers involving mathematics and science.

Contribution to Educational Knowledge.--This study may help others in the early identification of girls of promise who may choose careers involving science and mathematics. It may also aid in developing positive attitudes toward science among certain girls who express a preference for science or science-related careers.

Statement of Problem.--The central problem involved in this study is to test the null hypothesis that there are no differences in certain attitudinal and psychologic traits manifested by high school girls of above-average intelligence who prefer careers involving science and mathematics and those who do not.

Limitation of the Study.--This study was limited to a group of eighth, ninth, tenth, eleventh, and twelfth grade girls, whose I. Q.'s were 110 and above, who were enrolled in a Metropolitan Southeastern Public School System.

Purpose of the Study.--The main purpose of this study was to attempt to discover whether relatively high degrees of mental and social traits or combinations of such traits manifested by a selected group of

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[1] Ester Bumbley, "Our Greatest Waste of Talent is Women," Life, January, 1961, pp. 63-64.

girls with above-average intelligence are useful in motivating them to express a preference for mathematics, science or mathematics-science related careers.

The specific purposes were to answer the following questions:

1. What are the attitudes of the subjects toward pursuing careers involving science and mathematics?
2. What do the subjects indicate about the attitude of their parents concerning girls pursuing careers involving science and mathematics?
3. Is there a difference in the level of mechanical reasoning of the subjects who express a preference for careers which involve science and mathematics and those who express a preference for other kinds of careers?
4. Is there a difference in the level of comprehension of space relations of the subjects who express a preference for science and mathematics careers and those who express a preference in other areas?
5. Is there a difference in scientific occupational interest manifested by those who express a preference for science or mathematics as a career and those who express a preference for non-scientific careers?
6. Is there a difference in the essential features of the home background of the subjects who express a preference for science or mathematics careers and those who do not express a preference for science or mathematics careers?
7. What are the implications of the present study for educational theory and practice?

Definition of Terms.--For purposes of clarity in this study, the following terms have been defined:

1. "Attitude" - the concept of attitude accepted in this study, is what the attitude scale, "Attitudes Toward Science and Scientific Careers"[1] sought to measure.
2. "Manpower shortages" - refers to imbalances between the demand for and the supply of particular kinds of workers.[2]
3. "Science and mathematics careers" - refer to those technological careers involving strong academic preparation in the physical sciences such as chemistry, physics, mathematics, and biology.
4. "Space relations and mechanical reasoning" - relate to the students' abilities to visualize concrete objects and manipulate those visualizations, and to recognize everyday physical forces and principles.[3]

Locale of Study.--This study was conducted in a Southeastern Metropolitan School System during the second semester of the 1960-61 school term.

Method of Research.--The Descriptive-Survey Method of research,

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[1]Hugh Allen, Jr., Attitudes of Certain High School Seniors Toward Science and Scientific Careers (New York: Columbia University Press, 1959), pp. 43-52.

[2]National Manpower Council, Womanpower (New York: University Press, 1957), p. 255.

[3]George K. Bennett, et al., Manual for the Differential Aptitude Tests (New York: The Psychological Corporation, 1959), p. 5.

employing the specific techniques of testing and the use of the questionnaire, was used to gather and interpret the data necessary for the completion of the present study.

Description of Materials.--The basic points used in the description of the instruments used in this study were: (1) Content and (2) Purpose. The description of the test and questionnaire will be treated in the paragraphs which follow:

The questionnaire, Attitude Toward Science and Scientific Careers[1] was designed to ascertain the reactions of individuals toward science and scientific careers. It consists of two sections; namely, Section I - Personal Data and Section II - Attitude Scale.

The Otis Quick Scoring Mental Ability Test[2] was designed to secure a valid measure of thinking power or to determine the degree of maturity of the mind. It contains questions of different kinds with five answers given under each question.

The Bennett, Seashore, Wesman D. A. T. Mechanical Reasoning Test Form -A[3] was designed to measure ability to understand mechanical relations. The content is made up of drawings with simply phrased questions about them. The test is very useful in the selection of students for technical and engineering training.

The Bennett, Seashore, Wesman D. A. T. Space Relations Test

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[1]Special permission was granted for the use of this questionnaire by H. L. Forbner, Jr., Managing Editor, Bureau of Publications, Teachers College, Columbia University.

[2]Otis Quick Scoring Mental Ability Test, World Book Company.

[3]The Bennett, Seashore, and Wesman Mechanical Reasoning Test Form-A, Psychological Corporation.

Form-A[1] was designed to measure ability to think in terms of three dimentional structures. The questions are of multiple type which involves surface and rotation development. Power rather than speed determines the score.

The Lee and Thorpe Interest Inventory[2]--was designed to give an analysis of occupational choices in six fields of interest, however this study was concerned only with one field of interest--the sciences.

The special questionnaire was in the form of a check sheet, designed to ascertain the reactions of the subjects on what they indicated the attitudes of their parents were concerning girls pursuing scientific careers. This is an instrument of unknown reliability and validity, but it is assumed for purposes of the present study that the data obtained therefrom are useful for the purpose indicated. (See Appendixes for copies of these instruments.)

Selection of Subjects.--The subjects for this study were selected by the following procedure: The counselors of the participating schools were requested to furnish a list of all girls who on a previous test of mental ability administered by the school, obtained an I. Q. of 110 and above. In the six high schools selected there were in attendance 5,410 girls. The initial sample was a total of 158 girls. The Otis Quick Scoring Mental Ability Test was administered to this group by the writer during an afternoon testing period. There were 75 girls who scored in the I. Q. range 110 to 131. Four of the girls were dropped from the study because they were undecided in making a selection of a career choice. The

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[1]The Bennett, Seashore, and Wesman Space Relations Test Form-A Psychological Corporation.

[2]The Lee and Thorpe Occupational Inventory, California Test Bureau.

remaining sample consisted of 28 eighth graders, 20 ninth graders, eight tenth graders, six eleventh graders, and nine twelfth graders. The seventy-one girls who constituted the subjects of this study were further divided into two sub-groups; namely, those who expressed a preference for careers in science and mathematics, and those who expressed a preference for careers in other areas. There were 31 girls in the science preference group and 40 girls in the non-science preference group. This sub-division was accomplished by an analysis of question 21 of Section I - Personal Data of Attitude Toward Science and Scientific Careers. The data obtained from this analysis is shown in Table 1. An examination of Table 1 shows that a large percentage of the non-science preference group expressed an interest in teaching as a career in various areas, whereas those in the s science preference group rejected the notion of teaching in scientific endeavors.

TABLE 1

FREQUENCY DISTRIBUTION OF PREFERENCE OF CAREER CHOICES

Subjects Who Expressed a Preference for Science Career		Subjects Who Expressed a Preference for Non-Science Career	
Name of Career	Distribution	Name of Career	Distribution
Science Teacher	4	English Teacher-High School	2
Mathematician	8	Commercial Artist	1
Physician	3	Social Studies Teacher-High School	1
Physical Therapist	1	Social Worker	5
Medical Technician	3	Lawyer	6
Nursing	1	Foreign Language Teacher-High School	6
Dentist	1	Elementary Teacher	2
		Fashion Designer	1
		Journalist	2
		Social Science Teacher-College	1

TABLE 1, Continued

Subjects Who Expressed a Preference for Science Career		Subjects Who Expressed a Preference for Non-Science Career	
Name of Career	Distribution	Name of Career	Distribution
Research Scientist	2	Interior Designer	1
		Secretary	5
Chemist	1	Art Teacher-High School	1
		Home Economics Teacher-High School	1
Oceonographer	1		
		Metropolitan Opera Singer	1
Engineer	1		
		Music	1
Architectual Engineer	1	Writer-Poet	1
		Bus. Administration	1
Archeologist	1	English Teacher-College	1
Biologist	1		
Psychiatrist	2		
Total	31		40

The data ascertained from the administration of the Otis Quick Scoring Mental Ability Test to the initial sample of 158 girls and which yielded a final sample of 71 girls for this study are presented in the tables which follow:

Table 2 presents the distribution of the I. Q.'s of the total sample, Table 3 the distribution of I. Q.'s on the grade level, and Table 4 the following statistical measures: range, standard deviation, standard error of the mean, and the "z" - test of significant difference at the .01 level of confidence. With 69 degrees of freedom, the value of "z" at .01 level was found to be 0.710. Therefore, the statistics indicate that a significant difference does not exist between the mental ability of the two groups. If the subjects differ, the difference lies in other psychological factors which this study sought to determine.

TABLE 2

FREQUENCY DISTRIBUTION OF THE DERIVED IQ SCORES FOR SEVENTY-ONE GIRLS FROM THE OTIS QUICK SCORING MENTAL ABILITY TEST

IQ	Distribution Total	Distribution Science Group	Distribution Non-Science Group
130 - 131	2	2	0
128 - 129	0	0	0
126 - 127	1	1	0
124 - 125	2	0	2
122 - 123	4	1	3
120 - 121	7	4	3
118 - 119	4	4	0
116 - 117	11	1	10
114 - 115	13	6	7
112 - 113	13	5	8
110 - 111	14	7	7
Total	71	31	40

Operational Steps.--The operational steps for this research were as follows:

1. The related literature pertinent to this study was reviewed, summarized, and are presented in chapter I.
2. Permission to do this study was secured from the proper school authorities.
3. The subjects for this study were chosen from the eighth, ninth, tenth, eleventh, and twelfth grade girls whose I. Q.'s are 110 and above enrolled in the selected school system.

TABLE 3

FREQUENCY DISTRIBUTION OF IQ'S EIGHTH-TWELFTH GRADES OF THE SEVENTY-ONE SUBJECTS

	9th Grade		10th Grade		11th Grade		11th Grade		12th Grade		Total	
I. Q.	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
130 - 131	1		1								2	0
128 - 129					1						1	
126 - 127									1		1	
124 - 125		1				1						2
122 - 123	1	2								1	1	3
120 - 121	1	3	2						1		4	3
118 - 119	1		1		1		1				4	
116 - 117		5		2		1			1	2	1	10
114 - 115	1	2	1	1		2	2	1	1	1	5	7
112 - 113	1	1	2	6	1			1	1		5	8
110 - 111	5	3	2	2		1		1			7	7
Total	11	17	9	11	3	5	3	3	5	4	31	40

S-Subjects who expressed a preference for science careers
NS-Subjects who expressed a preference for non-scientific careers

TABLE 4

STATISTICAL DATA FOR THE I. Q. OF THE SEVENTY-ONE SUBJECTS AS DERIVED FROM THE OTIS QUICK SCORING MENTAL ABILITY TEST

Group	Name of Subject	Mean	Standard Deviation	Standard error of Mean	D_M	D_M	Z
Total	71	115.82	4.74	.556			
Group who Preferred Science Careers	31	116.31	5.57	1.02	0.86	1.21	0.710*
Group sho Preferred Non-Science Careers	40	115.45	4.03	6.45			

* Statistically insignificant

4. The test and questionnaires used in this study were administered on designated testing days.
5. The data were classified, organized, analyzed, and presented in Chapter II.
6. The summary, conclusions, implications, and recommendations are presented in Chapter III.

Collection of Data.--In order to secure data for this study a testing period of two weeks, beginning April 17 and ending April 28, was set up on a schedule worked out by the counselor of the participating schools. The Attitude Scale and the special questionnaire were administered within the period of afternoon testing sessions, and the Mechanical Reasoning, Spatial Relations, and Occupational Inventory were administered during morning testing periods. After completion of the testing, the test were scored by the writer with the use of self-scoring keys and the scores were tabulated, recorded, and treated in a statistical manner so as to answer the questions identified as specific purposes of this study. A description of the statistical treatment of the instrument used are in the subsequent paragraphs below.

Regarding the responses of Section II - Attitude Scale a Chi - square test of value was utilized to ascertain significant differences of the two groups of subjects for each statement. It must be stated, at this point, that while there was a possibility of five reactions, for purposes of computation of Chi-Square value, it was necessary to regard "completely agree" and "partial agreement" as an "agree" reaction; the other reactions ("neutral," "partially disagree" and "totally disagree") were regarded as "disagree reactions." This was done in order to obtain adequate cell frequencies for the computation of Chi-square values.

Whenever there was a cell which contain less than two reactions, the Chi-square was not calculated. The percentage comparison served as a means of obtaining an interpretative index to the particular statement. Percentage comparisons were used on the responses of subjects concerning the attitudes of their parents.

The percentile equivalents of the raw scores of Mechanical Reasoning, and Spatial Relations test were arranged into frequency distributions. The mean, standard deviation, standard error of the mean, and the "z" test were calculated. The percentiles were used for statistical calculations instead of the raw scores because the percentiles were different for each grade level.

The scores of the Occupational Inventory were arranged in a frequency distribution. The mean score, standard deviation, standard error of the mean, and the "z" test difference of significance were calculated.

Section I-Personal Data of the Attitude Scale provided the essential information concerning the features of home background of the subjects. The occupations of the fathers were placed into eight categories, tabulated, and percentages obtained for the groups. These categories were selected according to the classification of the National Bureau of Census Report.[1] Further the occupations were regrouped into professionals, and non-professionals. This was done in order to calculate Chi-square value. The occupations of the mothers were treated in a similar manner. In regrouping the occupations as professionals,

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[1] U. S. Department of Commerce, Bureau of the Census, 1950 Census of Population Volume II - Characteristics of the Population, Part I United States Summary, Washington, 1953. pp. 1-385; 1 - 390.

and non-professionals the categories housewives and deceased fathers were ignored. The information for the educational features of the parents was ascertained by methods of observation and analysis of percentage indices.

Survey of Related Literature

The literature pertinent to this study was reviewed under the following captions:

1. Qualities needed for careers in science
2. The extent of womens' education in science and mathematics
3. Achievements of women in science careers
4. Job opportunities for women
5. Previous research studies

Qualities Needed for Careers in Science.--Many boys and girls have the mistaken notion that they cannot pursue scientific or technological careers because they are not intellectual giants. While a certain amount of intelligence is needed, a significant factor is the ability to control the intelligence one has and to make it work in solving problems. Most educators have agreed that scientists are not born, they are trained.

Pollack believes that both enthusiasm and qualifications are necessary for careers in science. The chief qualities, he argues, are; a remarkable intelligence; mental alertness; the ability to observe accurately, to be logical and objective; to be able to work hard for long hours at a time, to have inexhaustible patience, and to be able to work harmoniously with people.[1]

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[1]Philip Pollack, op. cit., p. 30.

Robinson, of Hofstra College, in a feature article on Career Guidance, analyzed personal qualifications for the following careers in science:

> Chemists: Accuracy; inquiring mind; alertness; manipulative skill; willingness to accept responsibility, ability to speak clearly.
> Physicists: High level of intelligence; initiative, patience; resourcefulness; perseverance; accuracy; thoroughness; imagination.
> Microbiologist: Initiative; good health; accuracy; perseverance; patience; sensitive and objective observer; good judgment.
> Dentist: Manual dexterity; cleanliness; analytical mind; mechanical aptitude; pleasing personality.
> Engineers: Ability to work well with others; mechanical aptitude; accuracy; imagination; creativeness; patience; reliability; initiative; good judgment; manual dexterity; think, speak, and write clearly; leadership.
> Geophysicists: Stamina; like to travel; aptitude and interest in mathematics and physical sciences; work well with people; adjustment.
> Geologists: Like outdoors; fond of travel; work well with people; adjustable; good health; patience; imagination; resourcefulness.[1]

Nourse holds that the scientist must be fanatically honest and objective about his work to the extent that he will not settle for substitutes, half truths, frauds, or falsehoods. He lists the personal qualities that mean the most in a career in science as:

> A deep-seated, unshakable interest in science; an insatiable curiosity; a capacity for stubbornly hanging on through thick and thin to the end of a problem; the willingness to work hard and doggedly; the ability to find excitement and satisfaction in the day to day work in the laboratory with a problem which may never ultimately yield to the study.[2]

Waltz described the scientist by attempting to answer questions

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[1] H. Alan Robinson, "Career Guidance," Collier's Encyclopedia 1958 Year Book (New York: P. F. Collier and Son Corp., 1958), pp. 98-111.

[2] Allan E. Nourse, So You Want to Be a Scientist (New York: Harper and Brothers, 1960), p. 94.

such as: What makes a scientist? Are they genuises? Are they eccentrics? He contends that a few are geniuses, but that most are men and women of better-than-average intelligence; a few are eccentrics, but no more than in any other field or profession. Probably the most important single characteristic is the scientists ever-questioning curiosity about the things of nature.[1]

Zapoleon lists the following as characteristics of those talented in science and mathematics: a superior general intelligence (in the upper 20% of a general intelligence test); quantitative reasoning, verbal comprehension, mechanical reasoning, abstract reasoning, spatial visualization (measurable by standardized tests); ability to solve difficult problems, as distinct from speed in solving a series of simple ones; success in science and mathematics courses in school; extraordinary memory; intellectual curiosity; ability to apply knowledge to new situations; persistence in work.[2]

Rankin feels that "scientific talent" is largely a matter of interest. With interest the future scientist must have these additional qualities: patience, persistence, keen insight, common sense, imagination, a good sense of observation, curiosity, and intelligence.[3]

Brandwein states that it is obvious that high I. Q. alone or high scholastic averages do not guarantee success in science. The potential

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[1]George H. Waltz, What Makes A Scientist (New York: Doubleday and Company, 1959), p. 133.

[2]Marguerite W. Zapoleon, The College Girl Looks Ahead (New York: Harper & Brothers, 1956), p. 217.

[3]Betty Lou Rankin, "Woman's Place Is in the Lab Too," New York Times Magazine, April 19, 1959, p. 17.

scientist has a remarkable capacity to work and learn, to distinguish himself by winning honors, and has broad general ability, competence in mathematics, language and science, and usually shows inventiveness and high manual skill. He may be of good or poor background and of native or foreign extraction.[1]

Dr. Seaborg, chairman of the Atomic Energy Commission, defines the creative scientist as a "dedicated person of great natural intelligence who has been trained thoroughly and is hard at work on the frontiers of science."[2] In an article by Reporter Davis, Dr. Seaborg cited as identifying the four major factors which contribute to the development of a scientist as: intelligence, motivation; training; and a willingness to work.[3]

Many women have personal qualities of special value for scientific work. Among these are an engineering mind; imagination; and a penchant for detail, for orderly, logical thinking, for precise description and measurement, and for critical analysis of facts and theories. The basic requirements common to all scientific fields are interest and mental capacity that can be developed through specialized training to solve problems and search for a deeper understanding of the nature of things.[4]

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[1]Paul F. Brandwein, "The selection and Training of Future Scientists," The Scientific Monthly, March, 1947, p. 247.

[2]The Atlanta Journal, March 14, 1961, p. 7.

[3]Dr. Seaborg is in agreement with other science educators who feel that "the bulk of scientific discoveries are made by men with better-than-average intelligence rather than men of the genius category." Ibid.

[4]U. S. Department of Labor, Careers for Women in the Physical Sciences, Women's Bureau Bulletin 270, 1959, p. 2.

Certain personal traits and interest are important for a Career in geology, especially for field work. It would be desirable for students to like camping and out-door work, to be interested in travel and to possess the ability to take a certain amount of physical hardship in stride. They must also be adapted to life at high altitudes, in desert areas, and under varying conditions in inaccessible areas of the United States and foreign countries and must be able to work as part of a team. However, these characteristics may not be important in laboratory research, teaching and writing as in field research.[1]

Roe presents the following view-points on qualities needed for scientific careers; a strong curiosity, a strong drive for independence, and persistence. With these qualities the scientist needs also a good level of intelligence, not extremely high but above the average of verbal ability, spatial or mathematical ability, a relatively high energy level, and a cultural background, whether in the home or in his close surroundings, in which certain attitudes will be developed.[2]

She further points out that:

> In addition it would help considerably to be born the oldest son in a White Protestant family of middle-class background, with well educated parents, and a father in a profession, and to have above average needs for knowledge and beauty in your life and under average aggressive and social tendencies.[3]

Miles reports factors which contribute to the development of

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[1] Ibid., p. 39.

[2] E. Paul Torrance (ed.) Talent and Education, (The University of Minnesota Press, 1960)(Mimeographed), pp. 66-68.

[3] Ibid., p. 69.

talented not only in scientific endeavors but origin, growth, and development of all talents. Her conclusions of this discussion were:

1. Crucial for the development of talent is the presence of adequate intelligence.
2. High intellectual talent is more likely to be associated with higher intelligence than is requisite for the arts or administrative success.
3. The experience of the early years is crucial for the happy and full development of talent.
4. Suitable equipment available under appropriate conditions is of utmost advantage.
5. Variety of scene and of experience seems without exception favorable.
6. Association with people who are interesting and whose personalities and pursuits attract the young person carries on where home association leave off.
7. Crucial for the development of talent in a democracy is a democratic attitude toward it, and a democratic attitude of the talented toward themselves.[1]

With regard to qualities needed for careers in science, each of the science educators cited in the previous paragraphs argues for certain specific qualities such as good health, imagination, and mental alertness. All seem to be in agreement that the qualities necessary for success in scientific and technological areas are: a superior intelligence, coupled with being logical and objective, accurate observation, and hard work.

The Extent of Womens' Education in Science and Mathematics.--Many problems concerning the type of education for women have grown out of alleged intellectual, emotional and personality differences between men and women. Psychologists tell us that little, if any, differences exist in general intelligence between men and women. Test results of the General Aptitude Test Battery, developed by the U. S. Employment Service, also bear out the fact that there are no significant differences in aptitudes of boys and girls; and that there are greater differences among

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[1] Ibid., pp. 63-64.

individual girls and boys than between girls as a group and boys as a group. Moreover, what differences exist may be attributed largely to different experiences and background.

Regarding differences that exist in general intelligence between men and women, Montagu shares this information:

> With the exception of the test for arithmetic, mathematics, mechanics and mazes, females achieve significantly and consistently higher scores on intelligence tests than males. In arithmetic computation girls do better than boys, but they do not do as well in solving arithmetic problems and in arithmetic reasoning. Girls tend to excel in logical rather than rote memory, especially if the content of the test favors neither sex. Girls excel, on the whole, in general school achievement as measured by achievement tests and school grades.[1]

Mead argues that no one sex has a monopoly on certain traits or attributes. She says:

> We know of no culture that has said, articulately, that there is no difference between men and women except in the way they contribute to the creation of the next generation; that otherwise in all respects, they are simply human beings with varying gifts, no one of which can be exclusively assigned to either sex. We find no culture in which it has been thought that all identified traits-stupidity and brilliance, beauty and ugliness, friendliness and hostility, initiative and responsiveness, courage and patience and industry-are merely human traits. However differently the traits have been assigned, some to one sex, some to others, and some to both.[2]

Since psychologists and sociologists tell us there are no significant sex differences in intelligence, personality traits, citizenship responsibility, or in spiritual and personal needs, wherein lies the problem? Nevertheless analyses of Who's Who and other biographical catalogues revealed that there is a ratio of 92 per cent men to eight per

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[1]Ashley Montagu, The Natural Superiority of Women (New York: The Macmillan Company, 1957), p. 120.

[2]Margaret Mead, Male and Female (New York: William Morrow and Company, 1955), p. 17.

cent women in such directories.[1]

Blanding seemingly attempts to justify the woman's position when she declares that: "There are fewer great women doctors and scientists than men chiefly because fewer have entered these fields."[2]

With domestic and social changes as a result of the need for more manpower during World War II, and scientific and technological inventions, women are no longer chained to the drudgery of home duties. Women have proven that they can combine home and work and that they can do the job as well, and in some cases better than men.

There is, at the moment, a shortage of technologically trained people in all nations of the world. To make matters worse, engineering enrollments declined by more than 3% in 1959 after an 11% drop in 1958. Students of today are not responding to the existing needs.

While the supply of available engineers is falling off, the demand is increasing and will continue to increase sharply in the future. On the basis of present and projected enrollments and anticipated needs, the Department of Health, Education, and Welfare estimates that we will have a net deficit of about 100,000 engineers in 1965.[3]

Because there are not enough qualified men, women are being

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[1]Kate Muller, Educating the Woman for a Changing World (Minneapolis: Guide Press, 1954), p. 26.

[2]Sarah Gibson Blanding, "If I were President of a Men's College," Woman's Home Companion, December, 1947), p. 35.

[3]Hilliard W. Page, "The Challenge of Science As a Career," An address before the Third Annual Gifted Science Students Career Guidance Session at the Engineers' Club, Philadelphia, Pennsylvania, February 20, 1960, p. 3.

urged to go into training in engineering and the physical sciences in order that they may take their place side by side with men. Relative to this idea, Francis Maul cites Katherine Stinson who insists: "The fate of our civilization lies in the hands of the engineers and scientists. No one should deprive the American girl of her part in determining what our future is to be."[1]

An Educational Testing Service Survey of 1955 showed that boys and girls are not equally prepared for college entrance with respect to science and mathematics.[2] Of senior year students almost half of the boys, but less than one-tenth of the girls would have had more than six semesters of mathematics by the time they graduate. Almost one-tenth of the girls would have had no mathematics at all, and as many as one-fourth would have had only one or two semesters by graduation. In science the difference between girls and boys was not so great. Forty-five per cent of the boys and 50 per cent of the girls would have completed three or more semesters of work in science before graduation. Interest in additional courses in both science and mathematics was more pronounced among boys than girls, but almost 40 per cent of the girls indicated that they wish they had taken more courses in both fields.

A study by the United States Office of Education substantiates the findings that boys receive far more preparation than girls in mathematics and science. In 1954, almost as many girls as boys were enrolled in elementary mathematics courses in high schools. Boys made up about 60 per cent of enrollment in plane geometry and intermediate

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[1]Francis Maul, Executive Careers for Women (New York: Harper and Brothers, 1957), p. 143.

[2]National Manpower Council, op. cit., p. 177.

algebra; however, about 80 per cent in trigonometry and solid geometry. Girls outnumbered boys in biology courses, but in chemistry classes three-fifths, and in physics classes four-fifths of the students were boys.[1]

High school students who have a desire to pursue a scientific career should consult their school counselor to determine college entrance requirements and to make the proper selection of secondary subjects. Girls who plan a career in engineering and the physical sciences should select subjects which will prepare them for college work. Good high school preparation includes two science courses, chemistry, physics, biology and at least three years of mathematics and a good background of study in English, foreign languages and social studies. A course in technical drawing is also desirable.[2]

Generally anyone entering a scientific career must accomplish the four years of undergraduate college training, which will provide a broad background of general information in science. Attention is focused on rigid logical thinking which is needed through-out any scientific career. Much general knowledge is acquired of the basic laboratory sciences. (Chemistry, physics and biology). The work requires very little creative thinking; instead, time is spent on learning and understanding what is already known, and laboratory techniques developed.[3] Because scientists are increasingly using knowledge gained from scientific fields outside

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[1] Ibid., p. 178.

[2] U. S. Department of Labor, op. cit., p. 11.

[3] Alan Nourse, op. cit., p. 69.

their own specialty, it is generally recommended that undergraduate students obtain the broadest possible training in all branches of their chosen field and in related sciences. Common to all physical and biological sciences, however, is the need for a comprehensive grasp of mathematics and familiarity with laboratory routine. Basic courses in chemistry, physics, and biology are also generally prescribed.

Engineering curricula are divided into five groups: basic science; applied science, such as mechanical and geology; applied engineering courses, including machine design and plant lay-out; administration and management; special courses for educational background. The first year of college is much the same for all branches of engineering. Specialization comes later.[1]

Undergraduate training is not enough for assuming the really important functions of the scientist. The work towards the Masters degree will be the time when the future scientist will have an opportunity for retrospect, pointing up weaknesses and abilities and crystallizing interest. Since women are still pioneering in fields in which men predominate, they should be sure that their training is at least the equivalent of, if not better than, that of the men. For women, advanced degrees are extremely important since graduate level provides the best evidences of scientific competency. The women who go on for a doctor's degree in the sciences are rare. A recent study of the National Science Foundation revealed that in a recent year, in comparison to the 7,000 M. D. degrees granted only 986 individuals received Ph.D's. in chemistry; 470 in

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[1] Walter James Greenleaf, Occupations and Careers (New York: McGraw-Hill, 1955), p. 173.

physics; 230 in mathematics; 23 in astronomy and 10 in meterology. This reflects, to a large extent, the lack of interest in science that existed in our Country at this time. It also reflected the hard work, natural ability, and determination required to receive a doctorate in any scientific field. The scientist who holds a Ph.D. degree has proven ability in scientific training and research.[1]

Young women who aspire to highest professional recognition and greatest financial reward will have a definite advantage if they have a doctoral or medical degree. Many universities and some colleges require that most of their teaching staff have a Ph.D. or is working toward it, and a doctoral degree is also required of many research jobs.

Women have recently shown a growing interest in the study of biological sciences. Over 4,000 college degrees earned in this field were awarded to women in the academic year of 1958-59, compared with only 2,900 in 1955-56.[2]

According to the 1954-55 National Register of Scientific and Technical Personnel about 1,900 women were employed in chemistry. About two-thirds of the women chemists held graduate degrees. A high proportion of those holding bachelor's degrees had taken graduate work. A substantial majority held their highest degree in chemistry. Most of the remainder had majored in biochemistry, biological science or medicine.

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[1] Alan E. Nourse, op. cit., p. 83.

[2] Mary C. Murphy, "Careers For Women in the Biological Sciences," A Reprint from the Occupation Outlook Quarterly, Vol. III, No. 4, December, 1959, p. 2.

Of the three hundred physicists on the National Register, three out of four had taken their highest degree in physics and a majority of the remainder reported mathematics or chemistry. Graduate degrees were held by three out of four, and the number of doctoral degrees was almost as high as the master's degree.

There were 449 women on the register as mathematicians. 165 held doctoral degrees, 197 master's degrees, 86 bachelor's degrees and one, with less training than a bachelor degree.

Slightly more than 200 women were reported on the Register as geologists. Eighty-five per cent had taken their highest degree in geological sciences. Over half held graduate degrees, and nearly one out of five had attained the doctoral degree.

Forty-three women were registered as astronomers. The typical woman astronomer on the Register had achieved a graduate degree and had majored in astronomy. Four-fifths of the women astronomers had taken their highest degree in that science or in astrophysics; a few had majored in the related field of mathematics.

Twenty-six women meteorologists were reported on the Register. These women majored in a wide variety of subjects. Less than half of the women had taken their highest degree in meteorology. Almost as many had majored in such fields as mathematics, chemistry, or one of the biological or other physical sciences. A relatively high proportion had majored in non-scientific fields. Only nine had graduate degrees, most masters, many had taken some work beyond the bachelors degree. More than one out of four had attended college but had not received a degree. Most of the college employed held graduate degrees, while most of those employed by the Government had only a bachelor's

degree or no degree.[1]

The 1953 Survey of the Society of Women Engineers report these findings concerning the level of training and fields of preparation for engineering. Of the 600 questionnaires sent out, 264 replies were received. Ninety-seven per cent of the women had attended college, and 83 per cent of these had undergraduate degrees. Thirty-six per cent had taken some graduate work, and more than half of these had obtained at least the Master's degree. Nine women reported the acquisition of the doctorate degree, and several more were working toward the doctorate. Only three per cent of the women either had no college training, or failed to report training. About two-thirds of the women reported undergraduate training in an engineering field. Twenty-seven per cent took undergraduate specialization in mathematics, science, or architecture . The remainder had either been trained in such related fields as language, or political science or failed to report the type of training, or had taken no graduate work. Of the graduate degrees obtained, half were in mathematics, physics, or chemistry. The majority of the remaining graduate degrees were in engineering fields and a few were unrelated to engineering.[2]

While there is admittedly and obviously a paucity, of women pursuing scientific or technological careers the foregoing statistical data seem to indicate that there is a growing tendency for women to enter these heretofore neglected areas which have been predominately

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[1]U. S. Department of Labor, op. cit., pp. 60-77.

[2]U. S. Department of Labor, Professional Engineering, Women's Bureau Bulletin 254, 1954, p. 17.

populated by men.

The picture of women in science in the Soviet Union stands in bold contrast with that of American women. Statistics bear out the fact that Russia encourages, trains, and utilizes women in the scientific and technological fields. In Russia, 69% of all medical students are women; in the United States only 5.5% are women.[1] In Russia, 39% of the engineering students are women; in the United States, the figure is less than one per cent.[2]

Achievements of Women in Science Careers.--Many people know about the work of women in "male occupations" such as welders, and shipyard workers, during World War II, but probably few are aware of the valuable contributions made by women in the field of science and technology.

In the medical profession a woman doctor is not a rarity, since women have been famous in this field for centuries. Galen, who was born about 131 A. D. reports, in his writings, women physicians of the time, including Favilla, whose remedies he praised and Margaretha, an army surgeon. Later, in the seventh century, a woman named Trotula taught anatomy at medical school and her writings on this subject has been quoted for centuries. Among some of the noted women doctors carrying on this tradition in modern times is Dr. Alice Hamilton, who

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[1] In 1926, there were 20,000 women doctors in the Soviet Union. During 1928-29, nearly 6,000 more were graduated. See Esther Pohl Lovejoy, Women Doctors of the World (New York: The Macmillan Company, 1957), p. 170.

[2] Hilliard W. Page, loc. cit.

became America's foremost authority on illnesses caused by poison used in industry, and the first and only woman up to 1944 to be honored with the invitation to become a member of Harvard Medical School Faculty. Dr. Florence Rena Sabini, distinguished herself as the only woman to become full professor of medicine at Johns Hopkins Medical School, and won for herself a prominent place in twentieth century science with her contributions on blood vessels and tuberculosis.[1] Other women who became distinguished in medicine were Dr. Ellen H. Richards, whose studies on sanitation have become standard text books, and Major Margaret Janeway, who has the most extensive record of foreign service of any American woman doctor. For fourteen months she served overseas as head physician for the WAC in Italy and North Africa.[2] Dr. Janet Travell is now on the White House staff and enjoys the distinction of being the first woman to serve in that capacity.

Women are not newcomers in the field of chemistry. Marie Curie, a Polish woman, is the name apart from names of all women in the field of science. In the whole realm of science, no name or either sex, of any race, or any nationality shines with a purer lustre than hers. Madam Curie received the Nobel Prize in Chemistry in 1911, and was the only woman ever honored twice with this prize.[3] Another woman chemist of distinction is Dr. Marie Telkes, who became a leading authority in Solar Energy. As a civilian adviser in the Office of

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[1] Edna Yost, American Women of Science (New York: J. B. Lippincott Company, 1955), p. 44.

[2] Ibid.

[3] Philip Pollack, Careers and Opportunities in Science, p. 155.

of Scientific Research and Development during the last World War, she devised a sun-heating distilling system that converts sea water into drinking water. Then there is Miss Holyande D. Young, one of many women chemists cited in American Men of Science. Since 1945 she has been associated with the Argonne National Laboratory in Atomic Energy Projects.[1] Many other women chemists are: Sister M. Joan Presing, Professor of Chemistry and head of the Chemistry Department at the College of St. Francis, recipient of the first "Chemist of the Year" award; Miss Donna Cosulick, Senior research chemist at Lederles Laboratories, Pearl River, New York; Dr. Dorothy Wrinch, distinguished bio-chemist, well known for her work on the structure of insulin; Dr. Taisio Stodnichenko, who discovered germanium in coal ashes, and in the wood of pre-historic trees; Dr. Elizabeth S. Weirich, heads a staff of 11 women and 70 men at the Sears Roebuck Technical Laboratories, Chicago, Illinois, as well as an outstanding textile chemist; and Dr. Emma Perry Carr of Mount Holyoke, who has won numerous awards for research in petroleum hydrocarbonates.

Some women who have distinguished themselves as physicists are: Dr. Katherine Blodgett of the General Electric Laboratories, who developed an important method of coating lenses to eliminate reflections; Dr. Chung Kwai Luis Wei, research physicist at Westinghouse Electric Corporation; and Frances Pecjah, the first woman to join the staff of Atomic Scientists at Westinghouse. She conducted experiments with the cyclotron at the University of Pittsburgh and did research in higher-

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[1] Philip Pollack, Careers and Opportunities in Science (New York: E. P. Dutton and Company, 1960), p. 155.

energy fields.[1] Dr. Lise Meitner was to a large extent responsible for the fact that the United States developed the atom bomb before Nazi Germany.

A few women have established high reputations in the field of geology and astronomy. Mrs. Fanny Carter Edson was the first woman graduated with a degree in geology from the University of Wisconsin. She discovered that stones such as garnets and topaz could be used to identify the different types of oil sands in which they were found. It was an application of this theory that resulted in the discovery of the famous Marshall Pool, which has produced many millions of barrels of oil.[2] Her work in Paleontology is considered a valuable contribution to the science by the American Association of Petroleum Geologists.

Dr. Annie Jump Cannon, a Harvard astronomer, identified and classified more stars than anyone else in the world. She was recipient of the first honorary degree in science ever awarded to a woman by England's Oxford University, the first gold medal ever awarded a woman by America's National Academy of Science, and an honorary doctorate from Holland's University of Groningen. She was one of only six people to be made an honorary member of the Royal Astronomical Society.[3] Other women who became distinguished in astronomy are: Dr. Henrietta Leavitt of Harvard University, who formulated the "period luminosity law" which helps astronomers determine the galaxies. Miss Henrietta Sivope, research assistant at the famous Palomar Observatory and Helen Sawyer Hogg,

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[1] Ibid., p. 156.

[2] Edna Yost, op. cit., pp. 27-29.

[3] Ibid.

winner of the Annie Jump Cannon medal of the American Astronomical Society, became president of the Royal Astronomical Society of Canada.

Of the achievements in mathematics, many women claim prestige as applied mathematicians, statisticians and teachers. Dr. Marion C. Gray of the Bell Telephone Company is noted for her work in radio wave propagation and analysis of wave guides. She was formerly associated with the Imperial College in London and is a member of several mathematical societies in different countries.[1] Dr. Ida Mae Baker is teaching by radio practice material in mathematics and developing test material for evaluative thinking in quantitative solutions.[2]

That women have won their wings in engineering is evident by examining the records. The first known female engineer was Edith Julia Griswold, and the first woman in America to receive the engineering degree was Bertha Lomme. She was graduated from Ohio State University in 1893 and was employed by Westinghouse. Miss Edith Clark, was the first woman to be granted a degree in electrical engineering at Massachusetts Institute of Technology and one of the few members of the distaff side of the American Institute of Engineers.

Miss Frankie Barnett was the first woman structural engineer to be licensed in the State of Illinois. She showed herself to be superior scholastically to many male engineering students and her state board examinations were among the highest ever recorded.[3] Dr. Lillian Gilbert

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[1] Philip Pollack, Careers and Opportunities in Science, pp. 156-57.

[2] Jacques Cottel, American Men of Science (New York: R. R. Bowker Company, 1955), p. 74.

[3] Philip Pollack, Careers and Opportunities in Engineering, p. 108.

is internationally famous for her important contributions in the field of industrial engineering. Edna Yost describes her as "A management engineer who understood that industry's most important problem is the human being who works in it."[1] Mildred Pfister has served as consultant on water conditions and control of corrosion in steam plants, but later she became a special consultant in food processing plants and machinery.[2]

Job Opportunities for Women in Science Careers.--The Committee on Scientists and Engineers, in its report to President Eisenhower on October, 1957 stated:

> Obviously steps must be taken to break down employment barriers to women in science, engineering, and the technical fields. Public education programs of many varieties are needed to encourage young women to undertake science and engineering studies and to insure that they receive satisfactory employment after training. Long established prejudices against women in engineering and science need to be broken down not only among employers, supervisors, and co-workers but among women themselves.[3]

There are more women in science or in engineering than ever before. Of the possible 25,000, there are only ten women among every one hundred scientists, and only one among every one hundred engineers.[4]

Science is a broad occupation field that affords many opportunities for employment. One of the most important scientific activities often overlooked by girls and boys is the career in Science and mathematics teaching.

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[1]Edna Yost, op. cit., p. 99.

[2]Philip Pollack, Careers and Opportunities in Engineering, p. 110.

[3]Philip Pollack, Careers and Opportunities in Science, p. 160.

[4]Marguerite Zapoleon, op. cit., p. 215.

Pollack has this to say:

> There is a particular demand at the present time for science teachers, owing to an expanding school population. Schools and colleges are already overcrowded and thousand of applicants for admission to universities are being turned away for lack of facilities, yet authorities predict that by 1970 the number of enrolled students will be doubled the 1959 figure. A teacher shortage exists in high schools as well as in colleges. Thus, as against 6,998 vacancies for science teachers that existed for the 1958-59 term, there were only 4,926 graduates in 1958 who were qualified to teach science courses at the high school level. Said the National Science Foundation in 1959: "All indications point to no let up in the shortage of qualified teachers."[1]

Most scientist and engineers are employed in private industry, however a significant number prefer to work for the government. In 1954 more than fifty-three thousand five hundred physical, mathematical, and agricultural, biological and medical scientists were working for the federal government. Likewise during this same year there were forty-three thousand engineers in forty specialized fields on the payroll of Uncle Sam.[2] Many scientists prefer government work because it affords unusual wide opportunities for research, often offers participation in large scale development, and provides employment security.

Women scientist do many kinds of work: namely, research, technical writing, library work, inspection, teaching, design, computing, testing, supervisory consultative and administrative. They are employed by colleges, manufacturing plants, research firms, observatories, schools hospitals.[3] museums, institutes and federal, state, local and international government.

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[1] Philip Pollack, Careers and Opportunities in Engineering, p. 27.

[2] Ibid., p. 15.

[3] U. S. Department of Labor, Science Future for Girls, Women's Bureau Leaflet 32, 1959, p. 6.

The total employment in the biological sciences has been variously estimated between 50,000 and 85,000. Of this total 10 to 20 per cent is the estimate of women employment. The biologists work for educational institutions, government, agencies, private industry, establishments and non-profit organizations. Roughly, half of all workers in this field are teachers. The proportion of women among faculty members or women's colleges is one-half and almost a fifth in all colleges and universities. The proportion of women among high school biology teachers is perhaps as much as half. Women account for between 40 per cent and 60 per cent of the government personnel in State Health Department laboratories, and 15 per cent of the two-thirds work for federal agencies. Most private industries employ women biologists on their staff. In some, the proportion of women among their scientific personnel is quite high. However, relatively few women biologists have been promoted to supervisory or managerial positions.[1]

Women represent a fairly sizable proportion ranging from one-fourth to three-fifths of biologists employed by The Atomic Energy Commission Laboratories. Most of the women at these laboratories are employed in medical technology, general biology, physiology, biochemistry, cytology, genetics, pathology and enzymology. All branches of biology will be represented in the long range space programs. This new area of research ranges from systematic biology, which classifies species found in outer space, to psychology or human engineering, which studies anxiety, loneliness, performance, and other behaviorial manifestations. Relatively fewer women have had either the training or opportunity to

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[1] Mary C. Murphy, op. cit., p. 1.

participate in space biology research.[1]

Chemistry, the largest of all fields in the physical sciences employs about 12,000 women.[2] Zapoleon in his discussion points out that half of the women chemist currently employed work for manufacturers, especially of chemicals and foods. In private industry they work in business and repair firms, public utilities, stores, service industries, coal mining and crude petroleum companies. One-fourth of the women in chemistry work in colleges, medical and nursing schools, others serve as research, consulting, testing work. One-tenth of all women chemist are employed by the government mainly in research.[3]

Of the 900 women physicist the majority are engaged in college teaching, but there are women in all specialities including: Optics, nuclear physics, atomic and molecular physics, electronics, mechanics and heat, solid state physics, classical theory, quantum theory and accoustics. In the federal government women are employed in atomic and other physical research.

Nearly one-half of the 400 employed women geologist work in private industry, primarily for petroleum and natural gas or mining companies. Some are in field work and exploration, but most of them study fossils, minerals and other samples in research laboratories, or prepared technical reports on maps. The remaining opportunities are teaching in womens' colleges or large co-educational universities.

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[1] Ibid., p. 3.

[2] U. S. Department of Labor, Science Future for Girls, pp. 2-3.

[3] Marguerite Zapoleon, op. cit., p. 221.

Most of the 75 women astronomers are employed by universities and government. They compute the size, shape, motion and brilliance of celestial bodies; they study eclipses, star clusters, comets, and the fascinating possibilities of life on--and communication with other worlds. They predict tides, determine official time, make almanacs and navigation charts, and analyze orbits of man-made satellites.

In Meterology about 100 of the scientist are women. The United States Weather Bureau is the principal outlet for women meterologists in the United States. Most of them work in airports or general weather stations, where they do weather analysis and forecasting. Some, however work for Commercial Airlines, or in research laboratories or colleges where they not only teach meteorology but physics, mathematics or Geography.[1]

The largest group of women engineers, in the past, have worked on designs, contracts, costs and specification for highways, sanitation systems, dams, pipe lines, and various other structures designed by civil engineers. For other women engineers, private industry has been the largest outlet with government ranking second. Women electrical engineers find positions in the telephone industry, and in companies making electrical items. Women in civil engineering are usually restricted to office jobs. Their usual assignment is in design, drafting, mapping or other detail jobs. Two-thirds of the women chemical engineers are in clay-glass, and stone-products industries; with most of the others in petroleum refining and other chemical

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[1] Ibid., pp. 223-227.

industries.[1] Mechanical engineering is the largest single branch of the entire engineering profession. Regarding women in the engineering profession, Hammond feels:

> For normal times, the outlook for women graduates in mechanical engineering appears to be no brighter than it has been in the past. Industries in which most mechanical engineers are needed are those which don't hire women traditionally. Some opportunities are found here and there in design (especially household appliances) and drafting; most will continue to be found in related work such as technical publications, secretarial work, possibly patent work. Should war time conditions recur, women again would find themselves more welcome in this male dominated field.[2]

Women industrial engineers find work in manufacturing industries but, are most numerous in the machinery group. Their work is concerned with improving equipment and work processes for more effective use.

Woman is gradually being freed of the shackles that have long bound her to specific areas of endeavor. As the horizon of job opportunities for women widens, more concern will be given to qualification, training and experience than will be given to the sex of the prospective employee.

Previous Research Studies.--Maurice Finkle made a study of the factors affecting the high school students choice regarding a science career. Four sections of his report dealt with specific attitudes and competencies of high school principals, guidance counselors, science teachers, and students in relation to science courses. The objective of this study was to discover why students at the high school level chose to enter fields of endeavor other than science. He states that

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[1] Marjorie Hammon, Occupational Goals for College Students (Columbus, Ohio: State University Press, 1951), p. 47.

[2] Ibid.

it was believed that students have been exposed to certain conditions in the school which were of influence in their final choice of a career. Some of these factors may have been: (a) the interest in science shown by teachers (b) the guidance received by the students (c) the provisions made by the school in regard to the facilities and the use of the laboratory as an instrument of learning (d) the availability to the students of supplementary science activities (e) the presentation by the school of the course in science and mathematics necessary to provide students with the fundamentals in those areas. His findings state that the primary reason why students did not take more science while in high schools were: (1) Science was too difficult and involved too much mathematics; (2) The elementary school science course had been poor and un-interesting; and, (3) The school offered so many important and desirable courses in competition that students do not select science.[1]

A study was conducted by Glen Stice, Warren Torgerson, and William G. Mollenkope, on high school students and their plans. This was a national study and based on the responses of 9,689 seniors, who answered questions on motivation for college, interest in science, financial plans and parental backgrounds. All of the students scored high on the ability and, as a group, represented approximately the top thirty per cent of the entire sample. Among the findings were the following:

1. Approximately 14 per cent of the group said they had no interest in or desire to go to college, and 6 per cent said they had a strong interest in college but had no way of going.

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[1] U. S. Department of Health, Education and Welfare, Analysis of Research in the Teaching of Science: July 1955-56, Bulletin 1958, No. 7, 1958, p. 16.

2. Almost half indicated that expenses would be an important reason for not going.
3. Fifteen per cent of the boys and twenty-eight per cent of the girls had fathers whose education was limited to elementary school, had no interest in college.
4. Sixty-five per cent of boys whose fathers were doctors intended to go to college without delay. Twenty-eight per cent whose fathers were semi-skilled workers plan to go to college and only thirty-eight per cent whose fathers were farmers plan to go to college.
5. The lower the score on ability test, the greater was the percentage expressing no motivation for college.
6. The proportion of the students planning to go to college increased as the school population increased.
7. Approximately twenty-five per cent of the boys said they would like to become engineers, eight per cent wanted to enter medicine and six per cent wanted to be physical scientists.[1]

No information was given on the girls. Analyzing the findings the investigators' conclusions were:

1. A striking amount of economic and cultural determinism exists in connection with going to college.
2. There is a pressing need for more scholarships to reduce the loss to higher education of high ability students.
3. Higher education is losing up to one-half of the top 30 per cent of the nations high school seniors.
4. Lack of financies and lack of interest have about equal weight in causing the loss.[2]

Sylvia Neivert reported a study to investigate the problems of the identification of students with science potential and to determine what factors were responsible for their selecting science as a career. The research consisted of four major components:

1. Selecting, training, and following the careers of social groups of potential science students through high school and into colleges.
2. Administering the Test of Science Reasoning and Understanding of the College Entrance Board Examination, with an accompanying "Interest and Career Choice Questionnaire,"

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[1] Ibid., p. 17.

[2] Ibid., p. 17.

to several hundred science students in New York City and evaluating the data.
3. Reviewing the Annual Science Talent Search Competition.
4. Determining the characteristics of superior science teachers mainly by questionnaire sent to the sponsors of Science Talent Search Winners.

Some of the major conclusions of this study were:

1. Three factors necessary for high science potential, and for determining whether or not a student who possesses it will choose science as a career, are high intelligence, opportunities for development and personal attributes.
2. Outstanding performance in science requires the student to have an I. Q. of 135 or above and reading and arithmetic scores of 12th grade or better in the 9th year.
3. Opportunities for development include a home conducive to study and a school with an enrichment science program, marked by opportunities for individual research, good equipment and superior teaching.
4. The personal attributes by the potential science students fall into three categories--interest, individuality, and intrinsic factors. His individuality includes his personality traits, mental traits and work habits.
5. The science teacher is the single most important factor in the school environment conducive to development of potential science students.
6. The superior teacher who influences students to pursue science may be identified by his ability as a teacher and by his personality.[1]

Glen D. Vannatta conducted a study on background choices and opinions of superior mathematics students as a basis for an attack on scientific manpower shortage. The problem was to determine: (1) The present activities of students who ranked as winners in the state comprehensive mathematics contest, (2) Characteristics of the winner, (3) What caused them to make their particular choices.

Every contest winner was listed from 1952-1957. Of these 406 winners, 327 filled out and returned questionnaires.

Major findings and conclusions were:

1. To a small degree mathematics contest encourages students with high potentials.

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[1]Ibid.

2. A very high percentage of these superior students attend college. Most commonly their reason for not attending are marriage, and insufficient funds. A high per cent received aid from scholarship, but over fifty per cent also carry part or full time jobs.
3. The high school teacher has the greatest influence on students decisions to enter the field of mathematics; parent ranked second.
4. The facets of scientific work appealing most to the student appear to be challenge the unknown, and mental stimulation.[1]

Stanley Brown reports a study on Science Information and Attitudes possessed by California Elementary School Pupil:

The students of fifth and eighth grade level were selected in terms of geographical location. The following questions were used:

1. Is a functional understanding of facts, principles and concepts of science developed?
2. Are the areas of physical and biological sciences covered adequately?
3. Do the children realize and appreciate the independence of living?
4. Is the appreciation of an orderly universe operating under natural laws developed?
5. Are the pupils sensitive to the impact of scientific development?
6. Is the gap between scientific technology and curriculum content reduced.
7. Is scientific vocabulary developed?
8. Are pupils acquainted with the sources of scientific knowledge.
9. Is scientific attitude and method of critical thinking developed?
10. Is appreciation of constant improvement of living conditions developed?
11. Is understanding of natural resources included?
12. Is a functional understanding of health information and desirable hygienic habits developed?

The findings reveal the following data:

1. Since fifth and eight grade boys scored somewhat higher on the science information test than girls this differential suggest that the science program is set-up

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[1]Glen D. Vannatta, "Background, Choices, and Opinions of Superior Mathematics Students as a Basis for an Attack on Scientific Manpower Shortage." (Unpublished Ph. D. Dissertation, Indiana University, 1956),

to meet the needs of boys interest and presumedly fails to comply with femine application.

2. The science attitude revealed that the girls achieved slightly higher scores than the boys.
3. Significant differences were found between the attained mean scores of the fifth and eighth grade when compared on the science information test.
4. In comparison the percentage of favorable responses to the attitude test items by the fifth and eighth grade pupils, only a slight gain was apparent.
5. One can not assume the acquisition of desirable attitudes as always accompanying the learning and factual information.
6. The rural pupils possess superior science attitudes. Therefore it seemed apparent that urban and sub-urban schools should improve their method of teaching proper science attitudes. Education agrees that the most effective way of developing desirable attitudes is by teaching directly for them rather than expecting realization through transfer from the amount of science information.
7. More research is needed to develop curricula sequence, techniques of reading, audio visual material, teaching aids, and valued evaluative instruments in the field of education.
8. All elementary teachers should be encouraged to take science education at the pre-service or in-service levels.[1]

Brandwein made extensive studies on the gifted student as future scientist. As Chairman of the Science Department at Forest Hills High School, New York City, he became interested in developing a program of work and also a program of research to determine the nature of high level ability in science. His observations were based on the following:

1. Thirty-one working scientist from graduate students to those engaged in research on the highest level. The period of observation was 1931-1941.
2. Four hundred thirty-one boys and girls who indicated making science a vocation. This group designated as the Major Group was observed during 1943-1953 and furnished the base for observations and conclusions.
3. Two hundred sixty-three students of the freshmen classes (1944-1945) who were involved in a study of the stability of science interest.
4. Two hundred one students who were involved in a testing program to shed light on the question of whether high level ability could be predicted by tests. Tests conducted at high schools other than Forest Hills provides data for added observations.

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[1]Stanley B. Brown, Journal of Educational Research. June 4, 1929. 47: (1954) pp. 551-54.

5. Eighty-two teachers whose success in stimulating students of high level ability were also studied.[1]

His working hypothesis stated: High level ability in science is based on the interaction of several factors--genetics, Predisposing, and Activating. All factors are generally necessary to the development of high level ability in science; no one of the factors is sufficient in itself. The following are his basic inferences:

1. Future contributors to science may be identified on the school level by a training program (operational approach) or they may be identified by a testing program.
2. Science "talents" better called high level ability emerges out of general intelligence. High level ability is a combination of intellectual ability, inherited and developed; and is directly related to the early opportunities available for endeavors in science.
3. The number of future scientist is significantly related to the number involved in school science.
4. The very traits which characterizes students with high level ability in science identify the teacher with the qualities to furnish opportunities for youngsters with science potential.[2]

Some observations were:

1. Of the 431 students in the Major Group, 354 carried through the program for the high school period. Of these 354 who graduated in the Operational Approach 89 were thought to have potentialities for high level contribution to science.
2. Of 263 students of the freshman class who were involved in the study of stability of science interest, the results of the questionnaire administered indicated that 40 students, 33 boys and 7 girls, had a major interest in science. Only 18 of this forty sustained their interest in science throughout high school. The other 22 turned to different fields.
3. A follow up study showed that although 89 were selected out of 354 as judged as potential scientist to have the characteristics needed for success in scientific research. 90 per cent of the 354 were committed to science careers-engineering, medicine, dentistry, geology, psychology, and related fields.

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[1]Paul F. Brandwein, The Gifted Student As Future Scientist (New York: Harcourt Brace & Co., 1955), pp. 5-6.

[2]Ibid., p. 12.

4. Of the 82 teachers studied, more than 90 per cent had Masters Degrees in science, 50 per cent had matriculated for a doctorate degree in science or in education. There were 11 PhD's, 6 in science and 5 in education. More than 50 per cent had taught in colleges and more than 90 per cent had published at least one paper in science or education. All had good health, good school attendance and enjoyed interesting hobbies.[1]

Hugh Allen reported a study limited to a selected group of high school seniors in New Jersey which was an attempt to investigate attitudes toward science and scientific careers.

The purposes of this study were: (1) To determine what attitudes and opinions related to the scientific interprise were held by a selected group of high school seniors. (2) To determine whether a difference existed in the attitudes toward science and scientific careers held by students choosing science or a career and by those choosing other careers. (3) To determine the relationship of intelligence to the attitudes held.

His findings were discussed under the following three divisions: Attitudes, Career choice and Intelligence.

With regards to attitude he concludes that: (1) the students did possess attitudes favorable to science and the scientific endeavor as measured by the instrument in the study. (2) The students seem to have more constructive attitudes toward the scientific enterprise than had been indicated by other studies of similar nature. (3) As a group the New Jersey High school seniors were opposed to characterizing scientists as "long hairs," or "odd lot," "egg heads," communists," and against formal religion. (4) The students felt that science and technology have enriched society and are essential to its full development. (5) More

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[1] Ibid., p. 25.

than one-third of the group agreed that scientific findings always lead to final truths, and nearly one-half felt that scientific investigations are under taken for economic gain. (6) About 40 per cent of the students agreed that modern science is too complex for the average citizen to understand or appreciate.[1]

Under the question of careers his conclusions were concerned with four groups; namely, the science group who specified a scientific or science related career, the non-science group, who did not specify a science or science-related career, a high ability science group who specified a science or science related career, and a high ability non-science group, who did not specify a science or science related career. His findings were: (1) There were no significant differences between the science and non-science groups in their attitudes toward scientific enterprises. (2) There were no significant differences between high ability and non-science groups with respect to their attitudes toward science. (3) In greater numbers proportionally than the science group, the non-science student believed that scientist are unsociable, shy lonely, "egg heads" and that they are often willing to sacrifice the welfare of others to further their own interest. (4) More than a third of the non-science students felt that training for careers in science was not worth the time and effort required and 29 per cent testified that they did not have the intelligence for successful scientific careers.[2]

On the question of intelligence analysis of his data indicated that intelligence of the high school senior is related to his attitudes

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[1]Hugh Allen, Jr., op. cit., pp. 32-33.

[2]Ibid., pp. 34-35.

regarding science and the scientific endeavor and the higher the intelligence the greater the degree of constructive attitudes toward scientific enterprises.[1]

Summary of the Review of the Literature

1. The authorities and research in the field agree upon the important need to change the general and prevailing cultural notions about careers for women in science.
2. The studies indicate that a significant manpower dearth will be remedied by inducing more women into science and science-related careers.
3. Women possess the necessary qualifications, personal and other attributes which are requisite to careers in science.
4. Many women have been able to overcome social-cultural resistence of entry into scientific careers and attained outstanding achievements and many honors.
5. The various governmental, industrial, and other employment agencies are increasingly aware of the need to tap the vital woman resources for science and science related careers.
6. It is increasingly possible to identify those with potential for science and science-related careers at the secondary school level.

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[1] Ibid., p. 37.

CHAPTER II

PRESENTATION AND INTERPRETATION OF DATA

Introductory Statement.--The need for more scientists and engineers in a great number of fields is a result of the crescendo of the space race, industrial changes, and inventions. The United States faces a potential scientific shortage and, with the pace at which technology is progressing, will continue to face this shortage. The failure to encourage girls to enter the sciences is a loss of a valuable source of talent.

Many factors enter into a pupils choice in making a selection of a career: her interest, her ambitions, her abilities, the counsel she receives from her teachers, her friends and family, and the training opportunities afforded her in preparation for entering her chosen field. The problem became one of securing and analyzing data which might lead to an early identification of girls who express a preference for science and science related careers, in order that they may be trained, stimulated and encouraged to achieve the desired goals.

The purpose of this chapter is to report the findings as a result of this research in fulfillment of the specific purposes of this study.

Method of Interpretation of Data.--The following procedures were used in interpretation of the analysis of data presented in this study:

The tables on the Attitude Scale and occupations of the parents were interpreted in light of the percentage indices of the responses of the subjects and chi-square value computations. With one degree of freedom at the .01 level of confidence the value of chi-square would have to be as

large as or larger than 6.635 in order to be regarded as a significant difference. The tables on Mechanical Reasoning and Spatial Relations tests were set up from the data obtained from the mean centiles. The table on Occupational Interest Inventory was compiled on the data provided by the raw scores. The interpretations of these tables were made with reference to the critical ratio (Guilfords "Z"). With 69 degrees of freedom at the .01 level of confidence z would have to be as large as or larger than 2.6492 in order to indicate significance. The data on the educational background of the parents of the subjects were interpreted on the basis of the percentage indices.

Attitudes of the subjects toward pursuing careers envolving science and mathematics.--In order to determine whether or not the two groups of subjects hold significantly different attitudes toward the degree to which science is appreciated by most people, the data in Table 5 are presented and analyzed below.

Table 5 indicates that approximately 90% of the science preference group and 85% of the non-science preference group agree that science is not sufficiently appreciated by most people. Chi-square value indicated that there was no significant difference between the responses of the subjects on this issue.

TABLE 5

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE IS NOT SUFFICIENTLY APPRECIATED BY MOST PEOPLE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distri-bution	Per Cent	Distri-bution	Per Cent
Completely agree	15	48.38	20	50.00

TABLE 5, Continued

Subjects who prefer Scientific Careers			Subjects who do not prefer Scientific Careers		
	Distribution	Per Cent	Distribution	Per Cent	
Partially agree	13	41.93	14	35.00	
Neutral	2	6.45	1	2.50	
Partially Disagree	1	3.22	1	2.50	
Totally Disagree	0	0.00	4	10.00	
Total	31	99.98	40	100.00	
Agreement	28		34	62	Chi-square
Disagreement	3		6	9	$x^2 = 0.542$
Totals	31		40	71	

Table 6 presents data designed to ascertain whether or not the two groups of subjects held significantly different attitudes toward the idea that "Science is a systematic way of thinking."

An inspection of Table 6 reveals that about 64 % of the science group and 70 % of the non-science group agree that science is a systematic way of thinking. Although the non-science group had a 6% edge on the science group, there was no significant difference between the responses of the two groups according to chi-square calculations.

TABLE 6

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE IS A SYSTEMATIC WAY OF THINKING"

TABLE 6, Continued

Subjects who prefer Scientific Careers			Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	12	38.70	19	47.50
Partially agree	8	25.80	9	22.50
Neutral	4	12.90	8	20.00
Partially Disagree	6	19.35	2	5.00
Totally Disagree	1	3.22	2	5.00
Total	31	99.97	40	100.00

Agreement	20	28	48	Chi square
Disagreement	11	12	23	$x^2 = .249$
Totals	31	40	71	

To obtain a conclusion on whether or not the two groups hold different attitudes concerning the item, "Scientists are Seldom Concerned with Their Working Conditions," Table 7 is presented for an analysis.

With reference to Table 7, it is apparent that a high percentage of subjects of both groups rejected the notion that scientists are seldom concerned with their work. Fifty-eight per cent of the science preference group and 60% of the non-science preference group disagree with this issue. There was no significant difference between the responses of the two groups.

TABLE 7

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE SELDOM CONCERNED WITH THEIR WORKING CONDITIONS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	7	22.58	8	20.00
Partially agree	6	19.35	4	10.00
Neutral	4	12.90	1	2.50
Partially disagree	7	22.58	10	25.00
Totally disagree	7	22.58	17	42.00
Total	31	99.99	40	100.00

Agreement	13	12	25	Chi-square
Disagreement	18	28	46	$x^2 = 1.008$
Totals	31	40	71	

In order to determine whether or not the two groups of subjects hold significantly different attitudes concerning the concept that the development of new ideas is the scientist's greatest source of satisfaction, Table 8 is presented and analyzed.

Table 8 shows that the subjects possess a positive attitude concerning the statement that the development of new ideas is the scientist's greatest source of satisfaction. On this item, 84% of the science preference group and 82% of the non-science group are in agreement

Chi-square value shown in the table indicates the non-existence of a significant difference between the opinions of the two groups.

TABLE 8

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE DEVELOPMENT OF NEW IDEAS IS THE SCIENTIST'S GREATEST SOURCE OF SATISFACTION"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	18	58.06	19	47.50
Partially agree	8	25.80	14	35.00
Neutral	5	16.12	3	7.50
Partially Disagree	0	0.00	4	10.00
Totally disagree	0	0.00	0	0.00
Total	31	99.98	40	100.00

Agreement	26	33	59	Chi-square
Disagreement	5	7	12	$x^2 = 0.004$
Totals	31	40	71	

Table 9 is presented and analyzed to show how the subjects feel about the following statement: "Friends often discourage girls from taking high school science courses."

An inspection of Table 9 points out that 58% of the science preference group and 75% of the non-science preference group do not feel that friends often discourage girls from taking high school science courses

Although there was a 17% difference between the responses of the two groups in favor of the non-science preference group the difference was not significant.

TABLE 9

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "FRIENDS OFTEN DISCOURAGE GIRLS FROM TAKING HIGH SCHOOL SCIENCE COURSES"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	6	19.35	5	12.50
Partially agree	7	22.58	5	12.50
Neutral	5	16.12	4	10.00
Partially disagree	5	16.12	9	22.50
Totally disagree	8	25.80	17	42.50
Total	31	99.97	40	100.00

Agreement	13	10	23	Chi-square
Disagreement	18	30	48	$x^2 = 2.354$
Totals	31	40	71	

To ascertain the opinions of the two groups concerning the degree to which technology and science are important to the development of present-day culture an analysis and interpretation of Table 10 is presented.

Table 10 discloses that the subjects of both groups are in complete agreement that science and technology are essential to the development of

present-day cultures. Chi-square value substantiates the conclusion that no significant difference existed between the opinions of the subjects. An inference which seems justified is that a relatively large percentage of both groups feel that science has some cultural value.

TABLE 10

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE AND TECHNOLOGY ARE ESSENTIAL TO THE DEVELOPMENT OF PRESENT-DAY CULTURES"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	10	48.38	24	60.00
Partially agree	8	25.80	10	25.00
Neutral	7	22.58	3	7.50
Partially disagree	1	3.22	3	7.50
Totally disagree	0	0.00	0	0.00
Total	31	99.98	40	100.00

Agreement	23	34	57	Chi square
Disagreement	8	6	14	$x^2 = 1.329$
Totals	31	40	71	

Table 11 is presented for an analysis and interpretation to determine if there is a significant difference between the degree to which the two groups of subjects believe that increased radiation resulting from bomb tests is a threat to civilization.

An analysis of Table 11 implies that the subjects possess some scientific knowledge of possible radiation hazards associated with bomb tests and are aware of its after-effects. The majority agree that bomb tests are a threat to our civilization. There was no significant difference between the responses of the two groups.

TABLE 11

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "INCREASED RADIATION RESULTING FROM BOMB TESTS IS A THREAT TO CIVILIZATION"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	14	45.16	20	50.00
Partially agree	5	16.12	9	22.50
Neutral	8	25.80	5	12.50
Partially disagree	1	3.22	1	2.50
Totally disagree	3	9.67	5	12.50
Total	31	99.97	40	100.00

Agreement	19	29	48	Chi square
Disagreement	12	11	23	$x^2 = 0.522$
Totals	31	40	71	

In order to determine if the two groups of subjects hold significantly different viewpoints on the concept, "Scientist are too narrow in their views, Table 12 is presented and analyzed."

Table 12 denotes that the subjects reject the notion that scientists are too narrow in their views. Without the statistical aid of chi-square value intuitively a safe interence would seem to be that there was no significant difference between the responses of the two groups.

TABLE 12

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE TOO NARROW IN THEIR VIEWS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	1	3.22	5	12.50
Neutral	6	19.35	9	22.50
Partially disagree	8	25.80	6	15.00
Totally Disagree	16	51.61	20	50.00
Total	31	99.98	40	100.00

Agreement	1	5	6
Disagreement	30	35	65
Totals	31	40	71

Chi square x^2 = not calculated

Table 13 is presented and analyzed in order to ascertain how the subjects feel about the statement, "Industries use research as a means to improve their economic position."

With referenct to Table 12, the responses of both groups on this

item seem to have indicated that the subjects agree with the idea that, "Industries use research to improve their economic position." The differentation between the two groups was slight and the value of chi-square further substantiated the conclusion that the difference was not significant.

TABLE 13

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "INDUSTRIES USE RESEARCH AS A MEANS TO IMPROVE THEIR ECONOMIC POSITION"

Subjects who prefer Scientific Careers			Subjects who do not prefer Scientific Careers		
	Distribution	Per Cent		Distribution	Per Cent
Completely agree	15	48.38		17	42.50
Partially agree	5	16.12		9	22.50
Neutral	3	9.67		7	17.50
Partially disagree	8	25.80		4	10.00
Totally disagree	0	0.00		3	7.50
Total	31	99.97		40	100.00

Agreement	20	26	46	Chi square
Disagreement	11	14	25	$x^2 = 0.002$
Totals	31	40	71	

To determine the degree to which the two groups of subjects hold significantly different opinions on the statement, "The application of scientific knowledge to the development of new industries enriches society," Table 14 is presented and analyzed.

Examination of Table 14 points out that the subjects of both groups voice agreement with the item, The reactions of both groups infer that the subjects had a high degree of understanding of science's impact on society. Chi-square value indicated that there was no significant difference between the opinions of the subjects.

TABLE 14

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE APPLICATION OF SCIENTIFIC KNOWLEDGE TO THE DEVELOPMENT OF NEW INDUSTRIES ENRICHES SOCIETY"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	20	64.51	19	47.50
Partially agree	5	16.12	12	30.00
Neutral	6	19.35	5	12.50
Partially disagree	0	00.00	1	2.50
Totally disagree	0	00 .00	3	7.50
Total	31	99.98	40	100.00

Agreement	25	31	56	Chi square
Disagreement	6	9	15	$x^2 = 0.339$
Totals	31	40	71	

Table 15 is presented and analyzed to ascertain the degree to which the subjects hold significantly different views on the issue, "The president's cabinet should be enlarged to include a Secretary of Science."

With respect to Table 15, the agreements and disagreements of both groups of subjects were divided almost proportionately on the assertion that the president's cabinet should be enlarged to include a Secretary of Science. The difference that existed between the responses of the two groups as indicated by chi-square value was not significant. The reaction of the responses might have been an indication that the subjects do not have a clear understanding of the duties of a Secretary of Science.

TABLE 15

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE PRESIDENT'S CABINET SHOULD BE ENLARGED TO INCLUDE A SECRETARY OF SCIENCE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	7	22.58	18	45.00
Partially agree	9	29.03	5	12.50
Neutral	13	41.93	9	22.50
Partially disagree	1	3.22	6	15.00
Totally disagree	1	3.22	2	5.00
Total	31	99.98	40	100.00

Agreement	16	23	39	
Disagreement	15	17	32	Chi square
Totals	31	40	71	$x^2 = 0.231$

In order to determine how the two groups of subjects feel concerning

the issue, "Scientists and engineers should be eliminated from military draft, Table 16 is presented and analyzed."

An examination of Table 16 discloses that about 16% of the science preference group and 33% of the non-science preference group agree that scientists and engineers should be eliminated from the military draft. Although the percentage of the agreement responses of the non-science preference group was approximately double that of the science preference group, the difference was not significant as verified by chi-square value. A reasonable inference might be that the subjects feel that scientists and engineers are important for the military status of our country.

TABLE 16

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS AND ENGINEERS SHOULD BE ELIMINATED FROM THE MILITARY DRAFT"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	00.00	5	12.50
Partially agree	5	16.12	8	20.00
Neutral	3	9.67	2	5.00
Partially disagree	4	12.90	12	30.00
Totally disagree	19	61.29	13	32.00
Total	31	99.98	40	100.00

Agreement	5	13	18	
Disagreement	26	27	53	Chi-square
Totals	31	40	71	$x^2 = 2.814$

To show whether or not the subjects hold differences of opinions on the item, "The scientist will make his maximum contribution to society when he has freedom to work on problems which interest him," Table 17 is presented and analyzed.

It is apparent that, from the data on Table 17, the subjects project a relatively favorable attitude concerning the freedom that should be given the s cientist with regards to his work. Both groups agree with no significant difference between their responses.

TABLE 17

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE SCIENTIST WILL MAKE HIS MAXIMUM CONTRIBUTION TO SOCIETY WHEN HE HAS FREEDOM TO WORK ON PROBLEMS WHICH INTEREST HIM"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	12	38.70	16	40.00
Partially agree	9	29.03	10	25.00
Neutral	6	19.35	7	17.50
Partially disagree	3	9.67	4	10.00
Totally disagree	1	3.22	3	7.50
Total	31	99.97	40	100.00

Agreement	21	26	47	Chi-square
Disagreement	10	14	24	$x^2 = 0.148$
Totals	31	40	71	

To ascertain whether or not the two groups of subjects hold significantly different views toward the idea that scientists do not conform, Table 18 is presented and analyzed.

The data on Table 18 indicate that the two groups of subjects do not agree that a scientist might aptly be described as a noncomformist. About 74% of the science preference group and 70% of the non-science preference group reject the idea. The calculations of chi-square value indicate that there was no significant difference between the opinions of the groups.

TABLE 18

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "A SCIENTIST MIGHT APTLY BE DESCRIBED AS A NONCOMFORMIST"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	3	7.50
Partially agree	6	19.35	9	22.50
Neutral	10	32.25	10	25.00
Partially disagree	6	19.35	6	15.00
Totally disagree	7	22.58	12	30.00
Total	31	99.98	40	100.00

Agreement	8	12	20	Chi-square
Disagreement	23	28	51	$x^2 = 0.646$
Totals	31	40	71	

To reach a conclusion as to how the subjects feel concerning the item, "Scientist should be looked upon as 'subjects for suspicion'," Table 19 is presented for the purpose of an analysis.

An analysis of Table 19 shows that the subjects strongly reject the notion that the scientist should be looked upon as a subject for suspicion. Distribution of cell frequencies were not adequate for computation of chi-square value, but percentages indices indicate that the difference between the responses of the two groups was not significant. These results seem to provide an implication that the subjects possess a positive attitude toward the scientist as a "person."

TABLE 19

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS SHOULD BE LOOKED UPON AS 'SUBJECTS FOR SUSPICION' "

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	1	2.50
Partially agree	0	0.00	3	7.50
Neutral	3	9.67	8	20.00
Partially disagree	0	0.00	6	15.00
Totally disagree	27	87.09	22	55.00
Total	31	99.98	40	100.00

Agreement	1	4	5
Disagreement	30	36	66
Totals	31	40	71

Chi-square

x^2 = not calculated

Table 20 is presented and analyzed to show if the two groups of subjects hold significantly different views concerning the following issue: "Scientific investigations are undertaken as a means of achieving economic gain."

Table 20 reveals that the percentages of agreement of both groups indicate a slightly mixed reaction. Forty-seven per cent of the science preference group, and 37% of the non-science preference group agree with this issue. The calculation of chi-square value shows that there was no significant difference between the responses of the two groups.

TABLE 20

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC INVESTIGATIONS ARE UNDERTAKEN AS A MEANS OF ACHIEVING ECONOMIC GAINS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	3	9.67	4	10.00
Partially agree	12	38.70	11	27.00
Neutral	9	29.03	8	20.00
Partially disagree	6	19.35	11	27.50
Totally disagree	1	3.22	6	15.00
Total	31	99.97	40	100.00

Agreement	15	15	30	Chi-square
Disagreement	16	25	41	$x^2 = 0.939$
Totals	31	40	71	

In order to ascertain the degree to which the two groups of subjects hold significantly different attitudes concerning the idea that to become a scientist requires superior ability, Table 21 is presented and analyzed.

An investigation of Table 21 establishes the fact that the majority of both groups feel that in order to become a scientist it is necessary for one to possess superior ability. The statistics point out that there was no significant difference between the responses of the groups.

TABLE 21

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "TO BECOME A SCIENTIST REQUIRES SUPERIOR ABILITY"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	6	19.35	12	30.00
Partially agree	16	51.61	12	30.00
Neutral	3	9.67	3	7.50
Partially disagree	6	19.35	13	32.50
Totally disagree	0	0.00	0	0.00
Total	31	99.98	40	100.00

Agreement	22	24	46	Chi-square
Disagreement	9	16	25	$x^2 = 0.465$
Totals	31	40	71	

Table 22 is presented and analyzed to indicate whether or not the subjects hold significantly different ideas relative to the issue, "Science requires creative activity."

Table 22 reveals that the two groups are in agreement with the idea that, creative activity is required by science endeavors. Statistics show that no significant differences existed between the responses of the groups.

TABLE 22

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE REQUIRES CREATIVE ACTIVITY"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	9	29.03	12	30.00
Partially agree	14	45.16	14	35.00
Neutral	7	22.58	8	20.00
Partially disagree	1	3.22	5	12.50
Totally disagree	0	0.00	1	2.50
Total	31	99.99	40	100.00

Agreement	23	26	49	Chi-square
Disagreement	8	14	22	$x^2 = 1.066$
Totals	31	40	71	

To show whether or not the two groups of girls differ in their beliefs concerning the willingness of scientists to change their ideas when confronted with new evidence, Table 23 is presented for an analysis.

An inspection of Table 23 indicates that 74% of the science preference group and 83% of the non-science preference group agree that scientist are willing to accept change of beliefs and ideas when new evidence was found. No significant difference exist between the two groups as shown by chi-square value.

TABLE 23

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE WILLING TO CHANGE THEIR IDEAS AND BELIEFS WHEN CONFRONTED BY NEW EVIDENCE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	15	48.38	22	55.00
Partially agree	8	25.80	11	27.50
Neutral	3	9.67	2	5.00
Partially disagree	4	12.90	4	10.00
Totally disagree	1	3.22	1	2.50
Total	31	99.97	40	100.00

Agreement	23	33	56	Chi-square
Disagreement	8	7	15	$x^2 = 0.341$
Totals	31	40	71	

Table 24 is presented for the purpose of making an analysis in order to determine if the two groups held significantly different attitudes on the issue, "Scientist have unusually intelligent mothers."

It is apparent from an analysis of the data presented in Table

24 the subjects completely reject the notion that scientists have unusually intelligent mothers. All subjects in both groups feel that this is an erroneous idea.

TABLE 24

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS HAVE UNUSUALLY INTELLIGENT MOTHERS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	00.00	0	0.00
Partially agree	0	00.00	0	0.00
Neutral	13	41.93	5	12.00
Partially Disagree	5	16.12	10	25.00
Totally disagree	13	41.93	25	62.50
Total	31	99.98	40	100.00
Agreement	0	0	0	
Disagreement	31	40	71	Chi-square
Totals	31	40	71	x^2 = not computed

In order to reach a conclusion as to whether or not the two groups of subjects held significantly different viewpoints as to scientist being considered as "longhairs," the data is presented in Table 25 for the purpose of an analysis.

An investigation of the data in Table 25 establishes the fact that both groups of subjects feel that scientist are not "longhairs." An observation of percentage indices indicates that 90% of the science

preference group and 97% of the non-science preference reject this notion.

TABLE 25

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT" "SCIENTISTS ARE 'LONGHAIRS' "

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	1	2.50
Partially agree	2	6.45	0	0.00
Neutral	5	16.12	6	15.00
Partially disagree	2	6.45	11	27.50
Totally disagree	21	67.74	22	55.00
Total	31	99.98	40	100.00

Agreement	3	1	4	Chi-square
Disagreement	28	39	67	x^2 = not computed
Totals	31	40	71	

Table 26 is presented and analyzed to reveal the degree to which the subjects differ in their opinions on the item, "The complexity of science hides its cultural value."

An analysis of the statistical data of Table 26 shows that the two groups of subjects feel that the complexity of science does not hide its cultural values. The difference between the responses of the groups was not significant as indicated by the computation of chi-square value.

TABLE 26

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE COMPLEXITY OF SCIENCE HIDES ITS CULTURAL VALUES"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	4	10.00
Partially agree	9	29.03	7	17.50
Neutral	10	32.25	14	35.00
Partially disagree	5	16.12	9	22.50
Totally disagree	6	19.35	6	15.00
Total	31	99.97	40	100.00

Agreement	10	11	21	Chi-square
Disagreement	21	29	50	$x^2 = 0.276$
Totals	31	40	71	

To determine whether or not the two groups of subjects hold significantly different attitudes toward the degree to which modern science is too complicated for the average citizen to understand and appreciate, the data in Table 27 are presented and analyzed.

The data on Table 27 points out that 38% of the science preference group, and 18% of the non-science preference group agree that modern science is too complicated for the average citizen to understand and appreciate. A justified inference would seem to be that the subjects have a reasonably fair degree of understanding of the nature of science and its cultural values. The results indicate that the subjects feel

that modern science is not too complicated for the average citizen to understand and appreciate. Although there was a noticeable difference between the opinions of the two groups of subjects in favor of the science preference group this difference did not reach the significant level.

TABLE 27

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "MODERN SCIENCE IS TOO COMPLICATED FOR THE AVERAGE CITIZEN TO UNDERSTAND AND APPRECIATE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	00.00	0	00.00
Partially agree	12	38.70	7	17.50
Neutral	2	6.45	6	15.00
Partially disagree	8	25.80	10	25.00
Totally disagree	9	29.03	17	42.50
Total	31	99.98	40	100.00

Agreement	12	7	15	Chi-square
Disagreement	19	33	52	$x^2 = 4.267$
Totals	31	40	71	

Table 28 is presented and analyzed to establish whether or not the two groups of subjects hold significantly different attitudes toward the degree to which scientists possess too much power in our society.

A review of Table 28 shows that the subjects of both groups

indicate a strong tone of rejection toward the item, "Scientists possess too much power in our society." No significant difference existed between the responses of the groups.

TABLE 28

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS POSSESS TOO MUCH POWER IN OUR SOCIETY"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	1	2.50
Partially agree	2	6.45	2	5.00
Neutral	4	12.90	8	20.00
Partially disagree	10	32.25	8	20.00
Totally disagree	13	41.93	21	52.50
Total	31	99.98	40	100.00

Agreement	4	3	7	Chi-square
Disagreement	27	37	64	$x^2 = 0.170$
Totals	31	40	71	

Table 29 is presented to ascertain how the subjects feel about the following statement, "Decisive economic, political, and social processes are greatly influenced by science."

It is apparent from the data presented in Table 29 that the subjects feel that science has a great influence on economic, political, and social processes. The results of these responses indicate that the

subjects had a reasonable comprehension of science's impact on society. Chi-square value shows that there was no significant difference between the responses of the two groups.

TABLE 29

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "DECISIVE ECONOMIC, POLITICAL, AND SOCIAL PROCESSES ARE GREATLY INFLUENCED BY SCIENCE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	14	45.16	12	30.00
Partially agree	8	25.80	17	42.50
Neutral	6	19.35	4	10.00
Partially disagree	2	6.45	4	10.00
Totally disagree	1	3.22	3	7.50
Total	31	99.98	40	100.00

Agreement	22	29	51
Disagreement	9	11	20
Totals	31	40	71

Chi-square $x^2 = 0.011$

Table 30 is presented for an analysis to determine to what extent do the subjects hold significantly different attitudes toward the degree to which it is undemocratic to favor exceptional scientific talent.

Examination of Table 30 indicates that there was only slight agreement with the issue, "It is undemocratic to favor exceptional scientific talent." Observation of percentage indices shows that the

science preference group completely reject the notion whereas the non-science group slightly waver this idea.

TABLE 30

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "IT IS UNDEMOCRATIC TO FAVOR EXCEPTIONAL SCIENTIFIC TALENT"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	00.00	4	10.00
Partially agree	1	3.22	1	2.50
Neutral	9	29.03	13	32.50
Partially disagree	11	35.48	5	12.50
Totally disagree	10	32.25	17	42.50
Total	31	99.98	40	100.00

Agreement	1	5	6	Chi-square
Disagreement	30	35	65	x^2 = not computed
Totals	31	40	71	

In order to determine if the two groups of subjects hold significantly different viewpoints on the item, "The monetary compensation of a Nobel Prize winner in Physics should be at least equal to that given popular entertainers," Table 31 is presented and analyzed.

With regards to the data exhibited in Table 31, the responses of the two groups of subjects were divided equally across the board for agreement and disagreement. There was no significant difference between

the opinions of the two groups.

TABLE 31

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE MONETARY COMPENSATION OF A NOBEL PRIZE WINNER IN PHYSICS SHOULD BE AT LEAST EQUAL TO THAT GIVEN POPULAR ENTERTAINERS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	14	45.16	15	37.50
Partially agree	2	6.45	5	12.50
Neutral	6	19.35	8	20.00
Partially disagree	3	9.67	5	12.50
Totally disagree	6	19.35	7	17.50
Total	31	99.98	40	100.00

Agreement	16	20	Chi-square
Disagreement	15	20	$x^2 = 0.021$
Totals	31	40	

To show whether or not the two groups of subjects hold significantly different attitudes toward the degree to which hazards created by the increase use of radioactive materials make scientific work less attractive than previously, Table 32 is presented and analyzed.

With reference to item in Table 32, 23% of the science preference group and 50% of the non-science preference group agree. Although the larger percentage favors the non-science preference group, and the

computed value of chi-square was relatively high, the difference between the responses did not reach the level of significance. A logical inference would indicate that the non-science preference group probably rejects the preference of a science career because of the nature of the hazards created by the work.

TABLE 32

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "HAZARDS CREATED BY THE INCREASED USE OF RADIOACTIVE MATERIALS MAKE SCIENTIFIC WORK LESS ATTRACTIVE THAN PREVIOUSLY"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	7	17.50
Partially agree	5	16.12	13	32.50
Neutral	9	29.03	10	25.00
Partially disagree	9	29.03	6	15.00
Totally disagree	6	19.35	4	10.00
Total	31	99.98	40	100.00

Agreement	7	20	27	Chi-square
Disagreement	24	20	44	$x^2 = 5.641$
Totals	31	41	71	

Table 33 is presented and analyzed to find out if the subjects feel that scientists were shy, lonely individuals.

It is obvious that the data presented in Table 33 reveal that the girls in both groups strongly reject the notion that scientists are shy,

lonely individuals.

TABLE 33

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE SHY, LONELY INDIVIDUALS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	1	2.50
Partially agree	1	3.22	0	0.00
Neutral	5	16.12	3	7.50
Partially disagree	3	9.67	8	20.00
Totally disagree	22	70.96	28	70.00
Total	31	99.97	40	100.00
Agreement	1		1	
Disagreement	30		39	
Totals	31		40	

Chi-square

x^2 = not calculated

Table 34 is presented for the purpose of analysis to determine whether or not the groups of subjects hold significantly different convictions as to the degree to which loyalty checks and security clearances have seriously interfered with the work of scientists.

An analysis of Table 34 points out that both groups of girls feel that loyalty checks and security clearances should be made on scientists. The slight difference that exist between the responses of the two groups was not significant.

TABLE 34

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "LOYALTY CHECKS AND SECURITY CLEARANCES HAVE SERIOUSLY INTERFERED WITH THE WORK OF SCIENTISTS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	3	9.67	2	5.00
Partially agree	5	16.12	3	7.50
Neutral	18	58.06	19	47.50
Partially disagree	5	16.12	8	20.00
Totally disagree	0	00.00	8	20.00
Total	31	99.97	40	100.00

Agreement	8	5	Chi-square
Disagreement	23	35	$x^2 = 2.959$
Totals	31	40	

To determine the opinions of the two groups concerning the item, "For me training for a career in science is not worth the time and effort required" an analysis and interpretation of Table 35 is presented.

An inspection of Table 35 indicates that the two groups of girls strongly feel that training for a career in science is worth the time and effort. The attitude revealed as a result of an examination of this item is especially important in this study.

TABLE 35

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "FOR ME, TRAINING FOR A CAREER IN THE SCIENCES IS NOT WORTH THE TIME AND EFFORT REQUIRED"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	00.00	3	7.50
Partially agree	0	00.00	0	0.00
Neutral	2	6.45	2	5.00
Partially disagree	2	6.45	6	15.00
Totally disagree	27	87.09	29	72.50
Total	31	99.99	40	100.00

Agreement	0	3	Chi-square
Disagreement	31	37	x^2 = not computed
Totals	31	40	

Table 36 is presented and analyzed to ascertain whether or not the two groups of subjects hold significantly different notions relative to the issue, "Science is primarily a method for inventing new devices."

An examination of Table 36 indicates that the subjects' responses reflect a considerable amount of rejection to this item. These results would imply that the groups of girls have a reasonably clear understanding of the nature of science. Chi-square value indicated that there was no significant difference between the responses of the groups.

TABLE 36

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE IS PRIMARILY A METHOD FOR INVENTING NEW DEVICES"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	00.00	2	5.00
Partially agree	3	9.67	8	20.00
Neutral	2	6.45	4	10.00
Partially disagree	17	54.83	15	37.50
Totally disagree	9	29.03	11	27.50
Total	31	99.98	40	100.00

Agreement	3	10	13	Chi-square
Disagreement	28	30	58	$x^2 = 3.354$
Totals	31	40	71	

In order to determine the attitude of the subjects with regard to the scientists emotionalism, Table 37 is presented for an analysis.

An investigation of Table 37 indicates that the two groups of subjects feel that scientists are not more emotional than other people.

The differences between the responses of the two groups was not significant.

TABLE 37

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE MORE EMOTIONAL THAN OTHER PEOPLE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	1	2.50
Partially agree	0	0.00	2	5.00
Neutral	8	25.00	6	15.00
Partially disagree	6	19.35	14	35.00
Totally disagree	15	48.38	17	42.00
Total	31	99.98	40	100.00

Agreement	2	3	Chi-square
Disagreement	29	37	$x^2 = 0.094$
Totals	31	40	

Table 38 is presented and analyzed for the purpose of determining whether or not the subjects hold significantly different attitudes toward the degree to which girls have very little mechanical aptitude and, therefore, should not consider scientific careers.

An analysis of the data presented in Table 38 shows that both groups of subjects refute the idea that, girls have very little mechanical aptitude, and therefore should not consider scientific careers. These results are very important to this study.

TABLE 38

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "GIRLS HAVE VERY LITTLE MECHANICAL APTITUDE, AND THEREFORE SHOULD NOT CONSIDER SCIENTIFIC CAREERS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	1	3.22	1	2.50
Neutral	1	3.22	3	7.50
Partially disagree	1	3.22	7	17.50
Totally disagree	28	90.00	29	72.50
Total	31	99.98	40	100.00

Agreement	1	1	2	Chi-square
Disagreement	30	39	69	x^2 = not computed
Totals	31	40	71	

Table 39 is presented and analyzed to find out if the subjects feel that scientists are honored persons who stand very high in popular prestige.

Regarding the issue on the prestige of a scientist, Table 39 points out that 51 % of the science preference group and 53 % of the non-science preference group agree that scientist are honored persons. The slight difference indicated between the two groups was not statistically significant.

TABLE 39

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE HONORED PERSONS WHO STAND VERY HIGH IN POPULAR PRESTIGE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	6	19.35	6	15.00
Partially agree	13	41.93	15	37.50
Neutral	7	22.58	9	22.50
Partially disagree	2	6.45	9	22.50
Totally disagree	3	9.67	1	2.50
Total	31	99.98	40	100.00

Agreement	19	21	40	Chi-square
Disagreement	12	19	31	$x^2 = 0.465$
Totals	31	40	71	

In order to ascertain whether or not the two groups of subjects hold significantly different viewpoints toward the degree to which a person must understand the importance of science in order to appreciate modern society fully, Table 40 is presented and the data analyzed.

Concerning the issue, "To appreciate modern society fully, a person must understand the importance of science," Table 40 reveals that 65% of the science preference group and 78% of the non-science preference group were in agreement. Although the percentage of the non-science group was higher than the science group, the difference was not

significant as indicated by chi-square value.

TABLE 40

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "TO APPRECIATE MODERN SOCIETY FULLY, A PERSON MUST UNDERSTAND THE IMPORTANCE OF SCIENCE

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	12	38.70	18	45.00
Partially agree	8	25.80	13	32.50
Neutral	5	16.12	4	10.00
Partially disagree	3	9.67	3	7.50
Totally disagree	3	9.67	2	5.00
Total	31	99.96	40	100.00

Agreement	20	31	Chi-square
Disagreement	11	9	$x^2 = 1.271$
Totals	31	40	

Table 41 is presented and analyzed in order to determine if the two groups of subjects hold significantly different notions as to whether or not scientists are described as an "odd" lot.

An inspection of Table 41 discloses that both groups reject the idea that scientists are an "odd" lot. The agreement indices were very low. The computation of chi-square value indicated that there was not a significant difference between the opinions of the two groups of

subjects.

TABLE 41

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE AN "ODD" LOT"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	3	9.67	7	17.50
Partially agree	1	3.22	0	0.00
Neutral	4	12.90	7	17.50
Partially disagree	9	29.03	6	15.00
Totally disagree	14	45.16	20	50.00
Total	31	99.98	40	100.00

Agreement	4	7	11	Chi-square
Disagreement	27	33	60	$x^2 = 0.390$
Totals	31	40	71	

Table 42 is presented and analyzed to show the reactions of the two groups of subjects concerning the importance of mathematics to science.

An analysis of data in Table 42 indicates that both groups of subjects almost equally support the argument that science without mathematics is impossible. This result further substantiates the implication that the two groups of girls have an understanding of scientific knowledge.

TABLE 42

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE WITHOUT MATHEMATICS IS IMPOSSIBLE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	20	64.51	32	80.00
Partially agree	7	22.58	4	10.00
Neutral	2	6.45	3	7.50
Partially disagree	2	6.45	1	2.50
Totally disagree	0	0.00	0	0.00
Total	31	99.99	40	100.00

Agreement	27	36	63	Chi-square
Disagreement	4	4	8	$x^2 = 0.270$
Totals	31	40	71	

In order to show whether or not the two groups of subjects hold significantly different views concerning the item, "Science is the greatest unifying force among nations, Table 43 is presented for an analysis."

Examination of Table 43 points out that 61% of the science preference group and 60% of the non-science preference group accept the notion that, "Science is the greatest unifying force among nations." According to the computation of chi-square value, there was no significant difference between the reactions of the two groups.

TABLE 43

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE IS THE GREATEST UNIFYING FORCE AMONG NATIONS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	10	32.25	11	27.50
Partially agree	9	29.03	13	32.50
Neutral	8	25.80	11	27.50
Partially disagree	1	3.22	2	5.00
Totally disagree	3	9.67	3	7.50
Total	31	99.97	40	100.00

Agreement	19	24	43	Chi-square
Disagreement	12	16	16	$x^2 = 0.216$
Totals	31	40	71	

Table 44 is presented for the purpose of an analysis to determine the opinions of the two groups of subjects on the item, "Maintenance of scientific work is essential to national survival."

It is apparent from the data presented in Table 44, that about 90% of both the non-science preference group and the science preference group hold the opinion that maintenance of scientific work is essential to national survival.

TABLE 44

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "MAINTENANCE OF SCIENTIFIC WORK IS ESSENTIAL TO NATIONAL SURVIVAL"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	19	61.29	23	57.50
Partially agree	9	29.03	13	32.50
Neutral	3	9.67	4	10.00
Partially disagree	0	0.00	0	0.00
Totally disagree	0	0.00	0	0.00
Total	31	99.99	40	100.00

Agreement	28	36	64	Chi-square
Disagreement	3	4	7	$x^2 = 0.103$
Totals	31	40	71	

Table 45 is presented and analyzed to determine to what extent the subjects hold significantly different notions concerning the degree to which selfish individuals often hamper the use of scientific achievements.

In regards to the caption in Table 45, 52% of the science preference group and 75% of the non-science preference group agree that selfish persons often hamper the use of scientific achievement. Although there was a 23% difference between the responses of the two groups, this difference did not reach the significant level.

TABLE 45

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE USE OF SCIENTIFIC ACHIEVEMENTS IS OFTEN HAMPERED BY SELFISH INDIVIDUALS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	6	19.35	13	32.50
Partially agree	10	32.25	13	32.50
Neutral	9	29.03	11	27.50
Partially disagree	4	12.90	2	5.00
Totally disagree	2	6.45	1	2.50
Total	31	99.98	40	100.00

Agreement	16	26	42	Chi-square
Disagreement	15	14	29	$x^2 = 0.473$
Totals	31	40	71	

Table 46 is presented and analyzed to show if the subjects feel differently toward the assertion that "Scientific work is boring."

Examination of Table 46 shows that the two groups of girls did not agree with the idea, "Scientific Work is boring." The larger percentage of agreement on the part of the non-science preference group as compared with the science preference group may be regarded as a logical expectation.

TABLE 46

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC WORK IS BORING"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	6	15.00
Partially agree	3	9.67	4	10.00
Neutral	1	3.22	2	5.00
Partially disagree	6	19.35	12	30.00
Totally disagree	21	67.74	16	40.00
Total	31	99.98	40	100.00

Agreement	3	10	13	Chi-square
Disagreement	28	30	58	$x^2 = 1.129$
Totals	31	40	71	

In order to determine whether or not the two groups of subjects hold significantly different attitudes toward the degree to which culture is influenced by scientific activity, Table 47 is presented and analyzed.

With reference to Table 47, the data indicate that the responses in this item were equally distributed across the board for both the non-science preference group and the science preference group. The inference seem to claim that the groups of girls were not sure as to what degree scientific activity influenced culture.

TABLE 47

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC ACTIVITY IS GREATLY INFLUENCED BY CULTURE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	3	9.67	8	20.00
Partially agree	13	41.93	12	30.00
Neutral	9	29.03	14	35.00
Partially disagree	5	16.12	5	12.50
Totally disagree	1	3.22	1	2.50
Total	31	99.97	40	100.00

Agreement	16	20	36	Chi-square
Disagreement	15	20	35	$x^2 = 0.271$
Totals	31	40	71	

Table 48 is presented and analyzed in order to ascertain the opinions of the subjects concerning the issue, "The free flow of scientific information among scientists is essential to scientific progress."

Relative to the data exhibited in Table 48, 92% of the science preference group and 78% of the non-science preference group accept the statement that, "The free flow of scientific information among scientists is essential to scientific progress." The noticeable difference between the responses of the two groups did not reach the significant level. The

results on this issue indicate that the science preference group have a clearer understanding than the non-science preference group with respect to the nature of the work of science.

TABLE 48

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE FREE FLOW OF SCIENTIFIC INFORMATION AMONG SCIENTISTS IS ESSENTIAL TO SCIENTIFIC PROGRESS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	22	70.96	23	57.50
Partially agree	7	22.58	8	20.00
Neutral	2	6.45	5	12.50
Partially disagree	0	0.00	2	5.00
Totally disagree	0	0.00	2	5.00
Total	31	99.99	40	100.00

Agreement	29	31	60	Chi-square
Disagreement	2	9	11	$x^2 = 3.911$
Totals	31	40	71	

Table 49 is presented and analyzed to point out the degree to which the subjects differ in their convictions on the issue, "Scientists display an almost irrational attachment to their work."

An inspection of Table 49 shows that 58% of the science preference group and 45% of the non-science preference group feel that scientists

display an almost irrational attachment for their work. The 13% difference noted between the responses of the two groups was not significant.

TABLE 49

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS DISPLAY AN ALMOST IRRATIONAL ATTACHMENT TO THEIR WORK"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	7	22.58	10	25.00
Partially agree	11	35.48	8	20.00
Neutral	8	25.80	7	17.50
Partially disagree	2	6.45	8	20.00
Totally disagree	3	9.67	7	17.50
Total	31	99.98	40	100.00

Agreement	18	18	Chi-square
Disagreement	13	22	$x^2 = 0.917$
Totals	31	40	

Table 50 is presented and analyzed to ascertain the reactions of the two groups of girls relative to the statement, "I don't have the intelligence for a successful scientific career."

An inspection of Table 50 yields the following results: Both groups of subjects, on a whole, feel that they had intelligence for a

successful scientific career. In spite of the fact that 13% of the science preference group feel that they did not have the intelligence for a scientific career, the general reactions have a specific bearing on this research.

TABLE 50

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "I DON'T HAVE THE INTELLIGENCE FOR A SUCCESSFUL SCIENTIFIC CAREER"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	4	12.90	2	5.00
Partially agree	0	0.00	5	12.50
Neutral	3	9.67	6	15.00
Partially disagree	3	9.67	8	20.00
Totally disagree	21	67.74	19	47.50
Total	31	99.98	40	100.00

Agreement	4	7	Chi-square
Disagreement	27	33	$x^2 = 0.390$
Totals	31	40	

Table 51 is presented for an analysis to determine to what extent the two groups of subjects differ in their opinions pertaining to the degree to which the winning of the esteem of associates is a main incentive for the scientist.

Relative to the data presented in Table 51, it is apparent that the two groups of subjects did not feel that one of the main incentives for a scientist was winning associates esteem. The science preference group indicated a greater percentage of disagreement than the non-science preference group; however, this difference was not significant.

TABLE 51

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE WINNING OF THE ESTEEM OF HIS ASSOCIATES IS ONE OF THE MAIN INCENTIVES OF THE SCIENTIST"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	5	12.50
Partially agree	7	22.58	2	5.00
Neutral	6	19.35	17	42.50
Partially disagree	5	16.12	6	15.00
Totally disagree	11	35.48	10	25.00
Total	31	99.98	40	100.00

Agreement	9	7	16	Chi-square
Disagreement	22	33	55	$x^2 = 1.311$
Totals	31	40	71	

In order to analyze and interpret the reactions of the two groups of girls on the issue, "Scientific findings always lead to final truths, Table 52 is presented."

The data in Table 52 indicate that 57% of the science preference group and 42% of the non-science preference group accept the issue, Scientific findings always lead to final truths. The difference between the responses of the two groups was not significant, however, the results reveal a slight tone of mixed reactions in both groups.

TABLE 52

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC FINDINGS ALWAYS LEAD TO FINAL TRUTHS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	6	19.35	3	7.50
Partially agree	12	38.70	14	35.00
Neutral	4	12.90	6	15.00
Partially disagree	6	19.35	12	30.00
Totally disagree	3	9.67	5	12.50
Total	31	99.97	40	100.00

Agreement	18	17	35	Chi-square $x^2 = 2.063$
Disagreement	13	23	36	
Totals	31	40	71	

Table 53 is presented and analyzed to establish whether or not the subjects hold significantly different attitudes toward the degree to which scientists are concerned with the policies of the company for which they work as compared with other groups.

Inspection of Table 53 shows that 58% of the science preference group and 68% of the non-science preference group feel that scientists were as concerned with the policies of the company with which they work, as much as any other group. There was not a significant difference between the responses as indicated by chi-square.

TABLE 53

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE AS CONCERNED AS ARE OTHER GROUPS WITH THE POLICIES OF THE COMPANY FOR WHICH THEY WORK"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	12	38.70	24	60.00
Partially agree	6	19.35	3	7.50
Neutral	10	32.25	11	27.50
Partially disagree	3	9.67	1	2.50
Totally disagree	0	0.00	1	2.50
Total	31	99.97	40	100.00

Agreement	18	27	Chi-square
Disagreement	13	13	$x^2 = 1.030$
Totals	31	40	

To arrive at a conclusion as to whether or not the subjects hold significantly different attitudes toward the notion, "Industrial developments are based more on practical experience than on laboratory research,"

Table 54 is presented and analyzed.

An analysis of Table 54 points out that 19% of the science preference group and 20% of the non-science preference group agree with this item. These results indicate that the subjects of both groups feel that indistrial developments were not based more on practical experience than on laboratory research.

TABLE 54

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "INDUSTRIAL DEVELOPMENTS ARE BASED MORE ON PRACTICAL EXPERIENCE THAN ON LABORATORY RESEARCH"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	6	15.00
Partially agree	3	9.67	2	5.00
Neutral	6	19.35	8	20.00
Partially disagree	18	58.06	13	32.00
Totally disagree	4	12.90	11	27.00
Total	31	99.98	40	100.00

Agreement	3	8	11	Chi-square
Disagreement	28	32	60	$x^2 = 1.637$
Totals	31	40	71	

Table 55 is presented and analyzed to show something of the

feeling of the two groups regarding economic or monetary reward for the work of the scientist.

The data in Table 55 show that 29% of the science preference group and 33% of the non-science group agree with the item that the scientist can expect to accumulate little wealth as compensation for his work. The non-science group had a slightly stronger feeling than the science group that scientists do not receive enough compensation for their work. This difference, however was not significant.

TABLE 55

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE SCIENTIST CAN EXPECT TO ACCUMULATE LITTLE WEALTH AS A COMPENSATION FOR HIS WORK"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	6	15.00
Partially agree	7	22.58	11	27.50
Neutral	6	19.35	8	20.00
Partially disagree	11	35.48	11	27.50
Totally disagree	5	16.12	4	10.00
Total	31	99.98	40	100.00

Agreement	9	17	26	Chi-square
Disagreement	22	23	45	$x^2 = 0.680$
Totals	31	40	71	

Table 56 is presented and analyzed to determine the attitude the two groups of girls hold toward the issue that, "Science is a man's world."

An analysis of Table 56 indicates that the girls in both groups almost completely reject the notion: Science is a man's world; there is little room in it for women. The agreement responses on this item were three per cent for the science group and 10% for the non-science preference group.

TABLE 56

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE IS A MAN'S WORLD: THERE IS LITTLE ROOM IN IT FOR WOMEN"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	1	3.22	4	10.00
Neutral	0	0.00	2	5.00
Partially disagree	2	6.45	5	12.00
Totally disagree	28	90.32	29	72.50
Total	31	99.99	40	100.00

Agreement	1	4	5	
Disagreement	30	36	66	Chi-square
Totals	31	40	71	x^2 = not computed

In order to determine whether or not the two groups of subjects feel that science is primarily responsible for the frequent changes which occur in our manner of living, the data in Table 57 are presented and analyzed.

The data in Table 57 reveal that the subjects accept the statement that science is primarily responsible for frequent changes in our manner of living. The six per cent difference in favor of the science group was not significant.

TABLE 57

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE IS PRIMARILY RESPONSIBLE FOR THE FREQUENT CHANGES WHICH OCCUR IN OUR MANNER OF LIVING"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	14	45.16	21	52.50
Partially agree	12	38.70	10	25.00
Neutral	2	6.45	6	15.00
Partially disagree	2	6.45	3	7.50
Totally disagree	1	3.22	0	0.00
Total	31	99.98	40	100.00

Agreement	26	31	57	Chi-square
Disagreement	5	9	14	$x^2 = 3.161$
Totals	31	40	71	

In order to ascertain an analysis and interpretation of the reactions of the two groups of subjects on the idea that, "Scientists are 'eggheads'," Table 58 is presented.

An inspection of Table 58 discloses that the science preference group in totality reject the notion that "Scientists are 'eggheads'," in comparison with 78% of the non-science preference group. The apparent difference was not significant.

TABLE 58

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE 'EGGHEADS'"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	1	2.50
Partially agree	0	0.00	8	20.00
Neutral	6	19.35	2	5.00
Partially disagree	2	6.45	4	10.00
Totally disagree	23	74.19	25	62.50
Total	31	99.98	40	100.00

Agreement	0	9	9	Chi-square
Disagreement	31	31	62	x^2 = not computed
Totals	31	40	71	

Table 59 is presented and analyzed to indicate the degree to which the subjects differ in their opinions on the issue, "Scientific

work requires long years of labor and self discipline."

Examination of Table 59 points out that 87% of the science preference group and 65% of the non-science group agree that scientific work requires long years of labor and self discipline. There was no significant difference between the responses of the two groups.

TABLE 59

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC WORK REQUIRES LONG YEARS OF LABOR AND SELF DISCIPLINE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	12	38.70	19	47.50
Partially agree	15	43.38	7	17.50
Neutral	3	9.67	6	15.00
Partially disagree	1	3.22	4	10.00
Totally disagree	0	0.00	4	10.00
Total	31	99.97	40	100.00

Agreement	27	26	53	Chi-square
Disagreement	4	14	18	$x^2 = 3.828$
Totals	31	40	71	

In order to obtain a conclusion as to whether or not the two groups of girls hold significantly different attitudes toward the degree to which a great scientist has little concern with the practical application of his work, Table 60 is presented for the purpose of an analysis.

Concerning the data presented on the item in Table 60, 74% of the science preference group and 93% of the non-science preference group refute the issue that, "A great scientist is little concerned with the practical application of his work." Chi-square value indicated the difference between the responses of the two groups of girls was not significant.

TABLE 60

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "A GREAT SCIENTIST IS LITTLE CONCERNED WITH THE PRACTICAL APPLICATION OF HIS WORK"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	2	5.00
Partially agree	7	22.58	1	2.50
Neutral	3	9.67	5	12.50
Partially disagree	11	35.48	15	37.50
Totally disagree	9	29.03	17	42.50
Total	31	99.98	40	100.00

Agreement	8	3	11	Chi-square $x^2 = 3.911$
Disagreement	23	37	60	
Totals	31	40	71	

Table 61 is presented and analyzed to determine the degree to which the two groups of subjects believe that, "Scientist are communistic"

It is apparent that according to the data presented in Table 61,

the groups reject the idea that scientists are communistic. Only three per cent of the science preference group and five per cent of the non-science preference group were in agreement. Intuitively, without the statistical test difference, it would be logical to assume that there was no significant difference between the responses of the two groups.

TABLE 61

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE COMMUNISTIC"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	2	5.00
Partially agree	1	3.22	0	0.00
Neutral	4	12.90	8	20.00
Partially disagree	4	12.90	14	35.00
Totally disagree	22	70.96	16	40.00
Total	31	99.98	40	100.00

Agreement	1	2	3	
Disagreement	30	38	68	Chi-square
Totals	31	40	71	x^2 = not computed

To ascertain the views of the two groups concerning the item, "Science is an attitude toward life and environment" an analysis and interpretation of Table 62 is presented.

The data presented in Table 62 revealed that 42% of the science

preference group and 60% of the non-science preference group accept the notion that "Science is an attitude toward life and environment." Chi-square value shows that there was no significant difference between the responses of the groups.

TABLE 62

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE IS AN ATTITUDE TOWARDS LIFE AND ENVIRONMENT"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	10	32.25	19	47.50
Partially agree	3	9.67	5	12.50
Neutral	6	19.35	6	15.00
Partially disagree	5	16.12	3	7.50
Totally disagree	7	22.58	7	17.50
Total	31	99.97	40	100.00

Agreement	13	24	37	Chi-square $x^2 = 1.965$
Disagreement	18	16	34	
Totals	31	40	71	

Table 63 is presented for an analysis to determine to what extent do the subjects hold significantly different attitudes toward the degree to which our foremost scientists are primarily concerned with their own thoughts and ideas.

Table 63 points out that the subjects feel that our foremost

scientists are not primarily concerned with their own thoughts and ideas. Chi-square value indicated there was no significant difference between the responses of the two groups.

TABLE 63

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "OUR FOREMOST SCIENTISTS ARE PRIMARILY CONCERNED WITH THEIR OWN THOUGHTS AND IDEAS"

Subjects who prefer Scientific Careers			Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	4	12.90	7	17.50
Neutral	5	16.12	6	15.00
Partially disagree	15	43.38	17	42.50
Totally disagree	7	22.58	10	25.00
Total	31	99.98	40	100.00

Agreement	4	7	Chi-square
Disagreement	27	33	$x^2 = 0.279$
Totals	31	40	

In order to determine if the two groups hold significantly different viewpoints on the concept, "Science has done little for the average citizen," Table 64 is presented and analyzed.

An analysis of the data presented in Table 64 indicates that both groups of girls almost completely reject the notion that science

has done little for the average citizen.

TABLE 64

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE HAS DONE LITTLE FOR THE AVERAGE CITIZEN"

	Subjects who prefer Scientific Career		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	2	6.45	1	2.50
Neutral	0	0.00	4	10.00
Partially disagree	8	25.80	5	12.50
Totally disagree	21	67.74	30	75.00
Total	31	99.99	40	100.00

Agreement	2	1	3	Chi-square
Disagreement	29	39	68	x^2 = not computed
Totals	31	40	71	

Table 65 is presented and analyzed to show how the two groups feel about the following statement: "Scientific truths are usually found by persons seeking economic gain."

The data presented in Table 65 indicate that there was no significant differences between the responses of the two groups on the issue, "Scientific truths are usually found by persons seeking economic gains." Both groups strongly reject this item.

TABLE 65

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC TRUTHS ARE USUALLY FOUND BY PERSONS SEEKING ECONOMIC GAIN"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	2	5.00
Partially agree	3	9.67	2	5.00
Neutral	5	16.12	6	15.00
Partially disagree	10	32.25	10	25.00
Totally disagree	13	41.93	20	50.00
Total	31	99.97	40	100.00

Agreement	3	4	7	chi-square
Disagreement	28	36	64	$x^2 = 0.0941$
Totals	31	40	71	

Table 66 is presented and analyzed to determine to what extent the girls agree or disagree with the statement, "The neglect of basic scientific research would be the equivalent of 'killing the goose that laid the golden egg'."

Relative to the data presented in Table 66, 84% of the science preference group and 78% of the non-science preference group agree with this concept. The statistics substantiate the fact that both groups of subjects feel that basic scientific research should not be neglected.

TABLE 66

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE NEGLECT OF BASIC SCIENTIFIC RESEARCH WOULD BE THE EQUIVALENT OF 'KILLING THE GOOSE THAT LAID THE GOLDEN EGG'"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	17	54.83	24	60.00
Partially agree	9	29.03	7	17.50
Neutral	4	12.90	4	10.00
Partially agree	1	3.22	3	7.50
Totally agree	0	0.00	2	5.00
Total	31	99.98	40	100.00

Agreement	26	31	57	Chi-square
Disagreement	5	9	14	$x^2 = 0.363$
Totals	31	40	71	

To show the attitude of the two groups of girls toward the assertion that science does not receive enough serious attention in the mass media, Table 67 is presented and analyzed.

Concerning the statement on Table 67, the data show that 61% of the science group and 65% of the non-science group hold the opinion that science receives too little attention in the mass media. Computation of chi-square value indicated that there was no significant difference between the opinions of the two groups.

TABLE 67

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE RECEIVES TOO LITTLE SERIOUS ATTENTION IN THE MASS MEDIA"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	11	35.48	10	25.00
Partially agree	8	25.80	16	40.00
Neutral	8	25.80	7	17.50
Partially agree	3	9.67	4	10.00
Totally agree	1	3.22	3	7.50
Total	31	99.97	40	100.00

Agreement	19	26	Chi-square
Disagreement	12	14	$x^2 = 0.248$
Totals	31	40	

Table 68 is presented and analyzed to ascertain the reactions of the subjects on the following issue: "Scientists are subjected to too many governmental restrictions."

According to the statistical data presented in Table 68, it is apparent that 78% of the science preference group and 66% of the non-science preference group disagree with the issue. The 12% difference between the responses of the two groups in favor of the science group was not significant as indicated by chi-square value.

TABLE 68

DATA CONCERNING THE SUBJECT'S RESPONSES TO THE STATEMENT "SCIENTISTS TODAY ARE SUBJECT TO TOO MANY GOVERNMENTAL RESTRICTIONS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	3	7.50
Partially agree	8	25.80	11	27.50
Neutral	16	51.61	15	37.50
Partially disagree	4	12.90	6	15.00
Totally disagree	1	3.22	5	12.50
Total	31	99.98	40	100.00

Agreement	10	14	Chi-square
Disagreement	21	26	$x^2 = 0.015$
Totals	31	40	

In order to determine whether or not the two groups of subjects hold significantly different attitudes toward the degree to which the engineer serves a more practical purpose in society than does the research scientists, Table 69 is presented and analyzed.

Table 69 reveals that the two groups, the science preference group and the non-science preference group, of girls are of the opinion that the research scientists serves a more practical purpose in society than does the engineer.

TABLE 69

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE ENGINEER SERVES A MORE PRACTICAL PURPOSE IN SOCIETY THAN DOES THE RESEARCH SCIENTISTS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	2	5.00
Partially agree	5	16.12	2	5.00
Neutral	5	16.12	10	25.00
Partially disagree	15	48.38	16	40.00
Totally disagree	5	16.12	10	25.00
Total	31	99.96	40	100.00
Agreement	6		4	
Disagreement	25		36	
Totals	31		40	

Chi-square

$x^2 = 1.346$

In order to reach a conclusion as to how the subjects feel concerning the statement, "There is much self-satisfaction to be received from work as a scientists," Table 70 is presented and analyzed.

An inspection of Table 70 points out that 90% of the science preference group and 83% of the non-science preference group hold the conviction that much self-satisfaction is received from work as a scientist.

TABLE 70

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THERE IS MUCH SELF-SATISFACTION TO BE RECEIVED FROM WORK AS A SCIENTIST"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	17	54.83	21	52.50
Partially agree	11	35.48	12	30.00
Neutral	1	3.22	5	12.50
Partially disagree	0	0.00	1	2.50
Totally disagree	2	6.45	1	2.50
Total	31	99.98	40	100.00

Agreement	28	33	61	Chi-square
Disagreement	3	7	10	$x^2 = 0.576$
Totals	31	40	71	

Table 71 is presented and analyzed to establish to what extent the two groups of girls differ on the notion, "A scientist's life is full of adventure."

The statistical data presented in Table 71 show that both the science preference group and the non-science preference group of girls feel that a scientist's life is full of adventure. The percentage indices of the two groups were almost identical.

TABLE 71

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "A SCIENTIST'S LIFE IS FULL OF ADVENTURE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	15	48.38	18	45.00
Partially agree	8	25.80	11	27.50
Neutral	4	12.90	10	25.00
Partially disagree	3	9.67	1	2.50
Totally disagree	1	3.22	0	0.00
Total	31	99.98	40	100.00

Agreement	23	29	52	Chi-square
Disagreement	8	11	19	$x^2 = 0.087$
Totals	31	40	71	

To ascertain the viewpoints of the two groups relative to the issue, "The average American home discourages girls from scientific careers," Table 72 is presented and analyzed.

It is apparent that from the data presented in Table 72 that a large percentage of girls in both groups are of the opinion that the average American home does not discourage girls from pursuing scientific careers. The nine per cent difference between the responses of the two groups was not significant.

TABLE 72

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE AVERAGE AMERICAN HOME DISCOURAGES GIRLS FROM SCIENTIFIC CAREERS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	00.00	2	5.00
Partially agree	12	38.70	10	25.00
Neutral	6	19.35	7	17.50
Partially disagree	9	29.03	16	40.00
Totally disagree	4	12.90	5	12.50
Total	31	99.98	40	100.00

Agreement	12	12	24	Chi-square
Disagreement	19	28	47	$x^2 = 0.254$
Totals	31	40	71	

Table 73 presents the attitudes of the two groups pertaining to the following item: "Universities do little scientific research that is of immediate practical value."

An examination of Table 73 points out that the two groups on a whole reject the statement that universities do little scientific research that is of immediate practical value. The percentage of the science preference group was slightly higher than the non-science preference group, however this difference was not significant. These

results denote the implication that the subjects have a reasonable degree of understanding of the nature of scientific work.

TABLE 73

DATA CONCERNING THE SUBJECT'S RESPONSES TO THE STATEMENT "UNIVERSITIES DO LITTLE SCIENTIFIC RESEARCH THAT IS OF IMMEDIATE PRACTICAL VALUE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	0	00.00
Partially agree	5	16.12	5	12.50
Neutral	8	25.80	11	27.50
Partially disagree	11	35.48	13	32.50
Totally disagree	6	19.35	11	27.50
Total	31	99.97	40	100.00

Agreement	6	5	11	Chi-square
Disagreement	25	35	60	$x^2 = 0.435$
Totals	31	40	71	

Table 74 is presented and analyzed to determine whether or not the subjects hold significantly different attitudes toward the idea that great physical stamina is a requisite for a career in science.

An inspection of Table 74 discloses that the subjects feel that scientists did need the physical stamina necessary for most other work.

The low percentages of the agreement on this item verify this conclusion. The 19% difference between the reactions of the two groups of girls was not significant.

TABLE 74

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS DO NOT NEED THE PHYSICAL STAMINA NECESSARY FOR MOST OTHER WORK"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	0	0.00
Partially agree	6	19.35	3	7.50
Neutral	7	22.58	8	20.00
Partially disagree	7	22.58	8	20.00
Totally disagree	10	32.25	21	52.50
Total	31	99.98	40	100.00

Agreement	7	3	10	Chi-square
Disagreement	24	37	61	$x^2 = 0.528$
Totals	31	40	71	

In order to ascertain the degree to which the subjects differ in their opinions on the issue, "Science helps us to understand our environment," Table 75 is presented and analyzed.

The percentage indices noted in Table 75 justify the conclusion that the two groups of girls believe that science helps us to understand

our environment. The reactions of the two groups were almost equivalent.

TABLE 75

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE HELPS US TO UNDERSTAND OUR ENVIRONMENT"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	22	70.96	32	80.00
Partially agree	6	19.35	5	12.50
Neutral	3	9.67	3	7.50
Partially disagree	0	0.00	0	0.00
Totally disagree	0	0.00	0	0.00
Total	31	99.98	40	100.00

Agreement	28	37	65	Chi-square
Disagreement	3	3	6	$x^2 = 0.066$
Totals	31	40	71	

The data in Table 76 is presented for the purpose of an analysis in order to determine if the two groups of subjects hold significantly different views on the item, "Scientific concepts and discoveries often bring about new sociological problems."

With reference to Table 76 the data indicate that 74% of the science preference group and 55% of the non-science preference group favor the notion that scientific concepts and discoveries often bring about new sociological problems. The difference between the responses

of the two groups did not reach the significant level.

TABLE 76

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC CONCEPTS AND DISCOVERIES OFTEN BRING ABOUT NEW SOCIOLOGICAL PROBLEMS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	6	19.35	9	22.50
Partially agree	17	54.83	13	32.50
Neutral	8	25.80	12	30.00
Partially disagree	0	0.00	4	10.00
Totally disagree	0	0.00	2	5.00
Total	31	99.98	40	100.00

Agreement	23	22	45	Chi-square
Disagreement	8	18	26	$x^2 = 2.228$
Totals	31	40	71	

Table 77 is presented and analyzed to determine the reactions of the two groups of girls on the following statement: "Scientists are against formal religion."

An interpretation of the data on Table 77 points out that the science preference group completely reject the idea that scientists are against formal religion, whereas eight per cent of the non-science preference voice a rejection.

TABLE 77

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE AGAINST FORMAL RELIGION"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	1	2.50
Partially agree	0	0.00	2	5.00
Neutral	6	19.35	13	32.50
Partially disagree	6	19.35	4	10.00
Totally disagree	19	61.29	20	50.00
Total	31	99.98	40	100.00

Agreement	0	3	3	Chi-square
Disagreement	31	37	68	x^2 = not computed
Totals	31	40	71	

In order to ascertain whether or not the two groups of subjects hold significantly different attitudes toward the degree to which practical politicians and business men disregard the advice of scientists Table 78 is presented and analyzed.

Table 78 reveals that the subjects feel that practical politicians and business men do not disregard the advice of scientists. The results of these reactions show the positive attitude the subjects possess concerning science with reference to society.

TABLE 78

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "PRACTICAL POLITICIANS AND BUSINESS MEN DISREGARD THE ADVICE OF SCIENTISTS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	2	5.00
Partially agree	3	9.67	3	7.50
Neutral	10	32.25	20	50.00
Partially disagree	9	29.03	9	22.50
Totally disagree	9	29.03	6	15.00
Total	31	99.98	40	100.00

Agreement	3	5	8	Chi-square $x^2 = 0.414$
Disagreement	28	35	63	
Totals	31	40	71	

Table 79 is presented and analyzed to find out if the subjects feel that scientists often have physical deformities which render them unfit for other work.

An examination of Table 79 discloses that 93% of the science preference group and 82% of the non-science preference group register disagreement with the issue that physical deformities often possessed by the scientist leaves him unfit to perform other work.

TABLE 79

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS OFTEN HAVE PHYSICAL DEFORMITIES WHICH RENDER THEM UNFIT FOR OTHER WORK"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	1	2.50
Partially agree	2	6.45	2	5.00
Neutral	3	9.67	4	10.00
Partially disagree	10	32.25	10	25.00
Totally disagree	16	551.61	23	57.50
Total	31	99.98	40	100.00

Agreement	2	3	5	Chi-square
Disagreement	29	37	66	$x^2 = 0.3047$
Totals	31	40	71	

Table 80 is presented and analyzed to determine the extent to which the two groups of subjects agree or disagree with the statement, "Science and its inventions have caused more harm than good."

It is evident from an inspection of the data presented in Table 80 that the two groups of girls reject the notion that science and its inventions have caused more harm than good.

TABLE 80

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENCE AND ITS INVENTIONS HAVE CAUSED MORE HARM THAN GOOD"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	0	0.00	1	2.50
Neutral	3	9.67	3	7.50
Partially disagree	4	12.90	4	10.00
Totally disagree	24	77.41	32	80.00
Total	31	99.98	40	100.00

Agreement	0	1	1	Chi-square
Disagreement	31	39	70	x^2 = not computed
Totals	31	40	71	

In order to ascertain whether or not the two groups of subjects hold significantly different attitudes toward the item, "The social environment of the United States is hostile to the development of scientific talent," Table 81 is presented for the purpose of an analysis.

Table 81 shows that 90% of the science preference group and 82% of the non-science preference group did not feel that social environment of the United States is hostile to the development of scientific talent. These results indicate that both groups of girls possess positive

attitudes toward the relationship of social environment of the United States and the development of scientific talent.

TABLE 81

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE SOCIAL ENVIRONMENT OF THE UNITED STATES IS HOSTILE TO THE DEVELOPMENT OF SCIENTIFIC TALENT"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	3	9.67	7	17.50
Neutral	9	29.03	6	15.00
Partially disagree	10	32.25	9	22.50
Totally disagree	9	29.03	18	45.00
Total	31	99.98	40	100.00

Agreement	3	7	10	Chi-square
Disagreement	28	33	61	$x^2 = 0.428$
Totals	31	40	71	

Table 82 is presented and analyzed to determine if the two groups hold significantly different viewpoints on whether or not the Scientist can have a normal family life.

With regards to the data shown in Table 82, it is apparent that the two groups of girls feel that one could be a scientist and

have a normal family life.

TABLE 82

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "ONE CANNOT HAVE A NORMAL FAMILY LIFE AND BE A SCIENTIST"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	3	7.50
Partially agree	2	6.45	4	10.00
Neutral	3	9.67	6	15.00
Partially disagree	3	9.67	6	15.00
Totally disagree	23	74.19	21	52.50
Total	31	99.98	40	100.00

Agreement	2	7	9	Chi-square
Disagreement	29	33	62	$x^2 = 0.299$
Totals	31	40	71	

Table 83 is presented for the purpose of an analysis to determine the reactions of the two groups of subjects on the following notion: "The bulk of scientific research is carried on by devoted men and women without regard for their personal living or social relations."

An analysis of Table 83 reveals that the two groups of subjects disagree in identical veins with the notion that the bulk of scientific

research is carried on by devoted men and women without regard for their personal living or social relations.

TABLE 83

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE BULK OF SCIENTIFIC RESEARCH IS CARRIED ON BY DEVOTED MEN AND WOMEN WITHOUT REGARD FOR THEIR PERSONAL LIVING OR SOCIAL RELATIONS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	7	17.50
Partially agree	9	29.03	7	17.50
Neutral	6	19.35	7	17.50
Partially disagree	12	38.70	8	20.00
Totally disagree	2	6.45	11	27.50
Total	31	99.98	40	100.00

Agreement	11	14	25	Chi-square
Disagreement	20	26	46	$x^2 = 0.179$
Totals	31	40	71	

In order to determine to what extent the two groups of girls agree or disagree on the issue, "Public interest in science is essential to the maintenance of scientific research," Table 84 is presented and analyzed.

With reference to the data presented in Table 84, 86% of the science preference group and 68% of the non-science group accept the issue, "Public interest in science is essential to the maintenance of scientific research." Although there was a noticeable difference between responses of the two groups in favor of the science preference group, the difference was not significant.

TABLE 84

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "PUBLIC INTEREST IN SCIENCE IS ESSENTIAL TO THE MAINTENANCE OF SCIENTIFIC RESEARCH"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	11	35.48	13	32.50
Partially agree	14	45.16	14	35.00
Neutral	4	12.90	8	20.00
Partially disagree	1	3.22	5	12.50
Totally disagree	1	3.22	0	0.00
Total	31	99.98	40	100.00

Agreement	25	27	52	Chi-square $x^2 = 1.175$
Disagreement	6	13	19	
Totals	31	40	71	

Table 85 is presented and analyzed to point out what differences, if any, exist between the reactions of the two groups of girls on the

item, "Most of the basic research done in our country is carried on by industry."

An inspection of Table 85 points out that 48% of the science preference group and 28% of the non-science preference group feel that most of the basic research done in our country is carried on by industry. The 20% difference that existed between the two groups was not significant.

TABLE 85

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "MOST OF THE BASIC RESEARCH DONE IN OUR COUNTRY IS CARRIED ON BY INDUSTRY

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	5	12.50
Partially agree	14	45.16	6	15.00
Neutral	12	38.70	10	25.00
Partially disagree	4	12.90	18	45.00
Totally disagree	0	0.00	1	2.50
Total	31	99.98	40	100.00

Agreement	15	11	26	Chi-square
Disagreement	16	29	45	$x^2 = 3.384$
Totals	31	40	71	

In order to disclose to what extent the subjects agree or disagree on the statement, "Many scientific findings in science

contradicts the laws of God," Table 86 is presented and analyzed.

An examination of Table 86 indicates that the subjects of both groups do not accept the idea that many scientific findings in science contradicts the laws of God. Over 50% of the subjects in both groups register disagreement on this item.

TABLE 86

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "MANY SPECIFIC FINDINGS IN SCIENCE CONTRADICT THE LAWS OF GOD"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	5	16.12	10	25.00
Partially agree	5	16.12	6	15.00
Neutral	7	22.58	10	25.00
Partially disagree	8	25.80	4	10.00
Totally disagree	6	19.35	10	25.00
Total	31	99.97	40	100.00

Agreement	10	16	26	Chi-square
Disagreement	21	24	45	$x^2 = 0.248$
Totals	31	40	71	

To ascertain whether or not the two groups of girls hold significantly different attitudes toward the ascertion that American scientists are largely responsible for our country's status among nations, Table 87

is presented and analyzed.

The data presented in Table 87 show that 83% of the science preference group and 75% of the non-science preference group voice agreement with the idea, "American scientists are largely responsible for our country's status among nations." There was no significant difference between the responses of the two groups.

TABLE 87

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "AMERICAN SCIENTISTS ARE LARGELY RESPONSIBLE FOR OUR COUNTRY'S STATUS AMONG NATIONS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	12	38.70	15	37.50
Partially agree	14	45.16	15	37.50
Neutral	3	9.67	4	10.00
Partially disagree	2	6.45	4	10.00
Totally disagree	0	0.00	2	5.00
Total	31	99.98	40	100.00

Agreement	26	30	56	Chi-square
Disagreement	5	10	15	$x^2 = 1.351$
Totals	31	40	71	

Table 88 is presented and analyzed to show how the subjects feel about the following notion: "Scientists are essentially magicians,

making two blades of grass where one grew before."

Regarding Table 88, the data identified 29% of the science group and 34% of the non-science group who feel that scientists are essentially magicians. These results seem to contradict the results in previous items which denoted a sense of understanding of the work of scientists. The differences that existed between the two groups was not significant.

TABLE 88

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE ESSENTIALLY MAGICIANS, MAKING TWO BLADES OF GRASS WHERE ONE GREW BEFORE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	7	22.58	5	12.50
Partially agree	2	6.45	9	22.50
Neutral	12	38.70	8	20.00
Partially disagree	4	12.90	6	15.00
Totally disagree	6	19.35	12	30.00
Total	31	99.98	40	100.00

Agreement	9	14	23	Chi-square
Disagreement	22	26	48	$x^2 = 0.953$
Totals	31	40	71	

Table 89 is presented and analyzed to determine if the two groups of girls hold significantly different views toward the issue, "Industrial

research is often carried on by a team of scientific workers."

An investigation of Table 89 reveals that 90% of the science preference group and 75% of the non-science preference group believe that industrial research is often carried on by a team of scientific workers. Although the science preference group indicate a higher percentage of agreement responses than the non-science preference group, chi-square value revealed no significant difference.

TABLE 89

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "INDUSTRIAL RESEARCH IS OFTEN CARRIED ON BY A TEAM OF SCIENTIFIC WORKERS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	15	48.38	13	32.50
Partially agree	13	41.93	17	42.50
Neutral	1	3.22	9	22.50
Partially disagree	1	3.22	1	2.50
Totally disagree	1	3.22	0	0.00
Total	31	99.97	40	100.00

Agreement	28	30	58	Chi-square
Disagreement	3	10	13	$x^2 = 3.094$
Totals	31	40	71	

Table 90 is presented and analyzed to determine if the two groups of girls feel that scientific work is monotonous.

An inspection of Table 90 reveals that 87% of the science preference group and 85% of the non-science preference group do not feel that scientific work is monotonous.

TABLE 90

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTIFIC WORK IS MONOTONOUS"

Subjects who prefer Scientific Careers			Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	2	5.00
Partially agree	2	6.45	4	10.00
Neutral	3	9.67	10	25.00
Partially disagree	6	19.35	10	25.00
Totally disagree	18	58.06	14	35.00
Total	31	99.98	40	100.00

Agreement	4	6	10	Chi-square
Disagreement	27	34	61	$x^2 = 0.049$
Totals	31	40	71	

To obtain a conclusion on whether or not the two groups hold significantly different attitudes toward the item, "The working scientist believes that nature is orderly rather than disorderly," Table 91 is presented and analyzed.

An analysis of Table 91 shows that 74% of the science preference group and 40% of the non-science preference group were in agreement with the notion that, "The working scientist believes that nature is orderly rather than disorderly." According to calculation of chi-square value, the 34% difference between the responses of the two groups of girls in favor of the science preference group was significant.

TABLE 91

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE WORKING SCIENTIST BELIEVES THAT NATURE IS ORDERLY RATHER THAN DISORDERLY"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	12	38.70	12	30.00
Partially agree	11	35.48	4	10.00
Neutral	7	22.58	20	50.00
Partially disagree	1	3.22	1	2.50
Totally disagree	0	0.00	3	7.50
Total	31	99.98	40	100.00

Agreement	23	16	39	Chi-square
Disagreement	8	24	32	$x^2 = 8.288$
Totals	31	40	71	

Table 92 is presented and analyzed to show how the subjects feel about the following statement: "The modern world is dominated by science."

An examination of Table 92 discloses that 42% of the science preference group and 58% of the non-science preference group agree that, "The modern world is dominated by science." The difference between the responses of the groups was not significant.

TABLE 92

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE MODERN WORLD IS DOMINATED BY SCIENCE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	3	9.67	13	32.50
Partially agree	10	32.25	10	25.00
Neutral	10	32.25	11	27.50
Partially disagree	6	19.35	5	12.50
Totally disagree	2	6.45	1	2.50
Total	31	99.97	40	100.00

Agreement	13	23	36	Chi-square
Disagreement	18	17	35	$x^2 = 2.162$
Totals	31	40	71	

In order to determine the degree to which the two groups of girls hold significantly different opinions on the statement, "Scientists as a group are often condemned for the unpopular ideas and activities of a few fellow workers," Table 93 is presented and analyzed.

The data presented in Table 93 indicate that 42% of the science preference group and 45% of the non-science preference group feel that scientists as a group are often condemned for the unpopular ideas and activities of a few fellow workers.

TABLE 93

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS AS A GROUP ARE OFTEN CONDEMNED FOR THE UNPOPULAR IDEAS AND ACTIVITIES OF A FEW FELLOW WORKERS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	1	3.22	7	17.50
Partially agree	12	38.70	11	27.50
Neutral	9	29.03	10	25.00
Partially disagree	3	9.67	5	12.50
Totally disagree	6	19.35	7	17.50
Total	31	99.97	40	100.00

Agreement	13	18	31	Chi-square
Disagreement	18	22	40	$x^2 = 1.382$
Totals	31	40	71	

In order to ascertain whether or not the two groups of subjects hold significantly different attitudes toward the degree to which scientists are often willing to sacrifice the welfare of others to

further their own interest, Table 94 is presented for the purpose of an analysis.

Table 94 shows that 87% of both groups reject the idea, "Scientists are often willing to sacrifice the welfare of others to further their own interest."

TABLE 94

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE OFTEN WILLING TO SACRIFICE THE WELFARE OF OTHERS TO FURTHER THEIR OWN INTEREST"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	2	6.45	3	7.50
Partially agree	2	6.45	2	5.00
Neutral	5	16.12	9	22.50
Partially disagree	6	19.35	8	20.00
Totally disagree	16	51.61	18	45.00
Total	31	99.98	40	100.00

Agreement	4	5	9	Chi-square
Disagreement	27	35	62	$x = 0.192$
Totals	31	40	71	

Table 95 is presented and analyzed to determine to what extent the two groups of girls agree or disagree with the issue, "Scientists

are usually unsociable."

An interpretation of the data in Table 95 reveals that the subjects in both groups do not feel that scientists are usually unsociable.

TABLE 95

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "SCIENTISTS ARE USUALLY UNSOCIABLE"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	0	0.00	0	0.00
Partially agree	3	9.67	1	2.50
Neutral	2	6.45	8	20.00
Partially disagree	7	22.58	7	17.50
Totally disagree	19	61.29	24	60.00
Total	31	99.99	40	100.00

Agreement	3	1	4	Chi-square
Disagreement	28	39	67	x^2 = not computed
Total	31	40	71	

To show whether or not the subjects hold significantly different attitudes toward the notion, "Curiosity motivates scientists to make their discoveries," Table 96 is presented and analyzed.

Table 96 points out that 97% of the science preference group and 80% of the non-science preference group accept the notion, "Curiosity motivates scientists to make their discoveries." The percentage of

agreement of responses of both groups would seem to indicate that the difference that existed between the reactions of the subjects was not significant.

TABLE 96

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "CURIOSITY MOTIVATES SCIENTISTS TO MAKE THEIR DISCOVERIES"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	19	61.29	27	67.50
Partially agree	11	35.48	5	12.50
Neutral	0	0.00	4	10.00
Partially disagree	1	3.22	4	10.00
Totally disagree	0	0.00	0	0.00
Total	31	99.99	40	100.00

Agreement	30	32	62	Chi-square
Disagreement	1	8	8	x^2 = not computed
Totals	31	40	40	

Table 97 is presented and analyzed to determine the reactions of the two groups on the following item: "The chief reward in scientific work is the thrill of discovery."

With reference to the data presented in Table 97, it is apparent that both groups of girls accept the idea that, "The chief reward in

scientific work is the thrill of discovery."

TABLE 97

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "THE CHIEF REWARD IN SCIENTIFIC WORK IS THE THRILL OF DISCOVERY"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	18	58.06	23	57.50
Partially agree	7	22.58	11	27.50
Neutral	6	19.35	6	15.00
Partially disagree	0	0.00	0	0.00
Totally disagree	0	0.00	0	0.00
Total	31	99.99	40	100.00

Agreement	25	34	59	Chi-square
Disagreement	6	6	12	$x^2 = 0.412$
Totals	31	40	71	

In order to ascertain the viewpoints of the two groups relative to the issue: "In high school, boys receive more encouragement to take science courses than do girls," Table 98 is presented and analyzed.

An interpretation of Table 98 reveals that the agreements and disagreements of both groups were divided almost proportionally across the board on the issue, "In high school, boys receive more encouragement to take science courses than do girls." These results seem to indicate

that the girls are not clear as to how much encouragement they received in high school to take science courses as compared to boys.

TABLE 98

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "IN HIGH SCHOOL, BOYS RECEIVE MORE ENCOURAGEMENT TO TAKE SCIENCE COURSES THAN DO GIRLS"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	11	35.48	10	25.00
Partially agree	5	16.12	9	22.50
Neutral	2	6.45	11	27.50
Partially disagree	7	22.58	6	16.00
Totally disagree	6	19.35	4	10.00
Total	31	99.98	40	100.00

Agreement	16	19	35	Chi-square
Disagreement	15	21	36	$x^2 = 0.228$
Totals	31	40	71	

In order to find out how the two groups of girls feel about the statement, "Americans place greater value on the practical applications of scientific discoveries than on the discoveries themselves," Table 99 is presented for the purpose of an analysis.

The data presented in Table 99 point out that 67% of the science preference group and 43% of the non-science preference group agree that,

"Americans place greater value on the practical application of scientific discoveries than on the discoveries themselves." Although there was a noticeable difference between the responses of the two groups, this difference did not reach the significant level.

TABLE 99

DATA CONCERNING THE SUBJECTS' RESPONSES TO THE STATEMENT "AMERICANS PLACE GREATER VALUE ON THE PRACTICAL APPLICATIONS OF SCIENTIFIC DISCOVERIES THAN ON THE DISCOVERIES THEMSELVES"

	Subjects who prefer Scientific Careers		Subjects who do not prefer Scientific Careers	
	Distribution	Per Cent	Distribution	Per Cent
Completely agree	8	25.80	10	25.00
Partially agree	13	41.93	7	17.50
Neutral	9	29.03	21	52.50
Partially disagree	1	3.22	1	2.50
Totally disagree	0	0.00	1	2.50
Total	31	99.98	40	100.00

Agreement	21	17	38	Chi-square
Disagreement	10	23	33	$x^2 = 3.697$
Totals	31	40	71	

Summary.-- It is apparent from the analysis of data presented in the preceeding tables that the subjects of both groups in this study possess positive constructive attitudes toward scientific endeavors.

There were strong evidences of the following attitudes:

1. The subjects of the two groups have an understanding of science's impact on society, and society's impact on science. They feel that: (a) Science is not appreciated by most people; (b) Science and technology are essential to the development of present day culture; (c) Bomb test are a threat to society; (d) Industries use research as a means to improve economic position; (e) Scientist and engineers should not be eliminated from military draft; (f) Scientist do not possess too much power in our society; (g) Decisive economic, political and social processes are greatly influenced by science; (h) To appreciate modern science fully a person must understand the importance of science; (i) Science and its inventions have not caused more harm than good (j) Science has done much for the average man; (k) Scientific concepts and discoveries often bring about new sociological problems; (l) Loyalty checks and security clearances have not seriously interfered with work of the scientists; (m) Scientist are not subjected to too many governmental restrictions; and (n) Public interest in science is essential to maintenance of scientific research.
2. The subjects of both groups possess a favorable "image" of the scientist. They believe that: (a) Scientists are not too narrow in their views; (b) Superior ability is necessary to become a scientist; (c) Scientists are willing to change their ideas and beliefs when confronted by new evidence; (d) Scientist are not "long hairs," "eggheads," or "odd lots";

(e) Scientists are not shy, lonely individuals, neither are they less emotional than other people; (f) Scientists are not communistic; (g) Scientists need stamina for their work; and (h) Scientists are not against formal religion.

3. The subjects of the two groups have a reasonable degree of understanding of scientific work and the nature of science. They think that: (a) The development of new ideas is the scientists greatest source of talent; (b) Freedom should be given the scientist with regard to his work; (c) Scientific work is not boring; (d) Scientific work requires long years of labor, self discipline, and team work; (e) The research scientist serves a more practical purpose than the engineer; (f) The chief reward in scientific work is the thrill of discovery; (g) the Complexity of science does not hide its cultural values; (h) Modern science is not too complicated for the average citizen to understand; (i) Science is an attitude toward life, and helps us to understand our environment; (j) Creative activity is required by science endeavors; (k) The free flow of scientific information among scientists is essential to scientific progress; and (l) Science without mathematics is impossible.

4. The subjects of both groups of girls possess strong personal attitudes favorable for scientific enterprises. They feel that; (a) For them training for a career in science is worth the time and effort; (b) They have the intelligence for a successful scientific career.

Attitudes of the parents indicated by the subjects concerning

girls pursuing careers involving science and mathematics.--In order to reveal whether or not the two groups of subjects hold significantly different attitudes toward the degree to which their parents were for or against girls pursuing careers involving science and mathematics the data are presented and analyzed in Tables 100 and 100-A.

An analysis of Tables 100 and 100-A discloses that 94% of the science preference group and 40% of the non-science preference group expressed the opinion that their mothers would not object to careers involving science and mathematics for girls. Seventy-four per cent of the science preference group and 40% of the non-science preference group hold the opinion that their fathers would not object to science careers for girls. Neither the science preference group nor the non-science preference group expressed belief that their mothers would object to science careers for women. The science preference group indicated by their responses that their fathers would not object to women in scientific enterprises, while five per cent of the non-science preference group indicated that their fathers would voice an objection. Three per cent of the girls in the science preference group could not be certain of or know how their mothers would feel about women in science related careers. Twenty-eight per cent of the girls in the non- science preference group were uncertain about how their mothers would feel about girls in science related careers while 33% of the girls did not know definitely about how their mothers would feel about women in science. Thirteen per cent of the girls in the science preference group indicated that they could not be certain about how their fathers would feel about women in science areas. In the non-science preference group 20% of the subjects were uncertain about the attitudes of their fathers toward women in science

areas while 28% stated positively that they did not know what their fathers' attitude would be. The percentage indices seem to indicate that there was a noticeable difference between the responses of the two groups of girls concerning what would be the attitudes of their parents toward girls choosing science careers. The non-science preference group expressed a greater degree of uncertainity and entered "don't know" as an answer than did the science preference group. Three per cent of the science preference group expressed the belief that their guardian would not object to science related careers for women and three per cent of the girls in the science preference group indicated that they did not know how their guardian would feel about scientific endeavors for women. It was not determined in this study whether or not the guardian was a mother or father.

TABLE 100

RESPONSES OF SUBJECTS CONCERNING THE ATTITUDES OF PARENTS TOWARD GIRLS PURSUING CAREERS INVOLVING SCIENCE AND MATHEMATICS

	SUBJECTS WHO PREFER SCIENTIFIC CAREERS			%	%	%
	Mother	Father	Guardian	Mother	Father	Guardian
For	29	23	1	93.6	74.2	3.2
Against	-	-	-	-	-	-
Uncertain	1	4	1	3.2	12.9	3.2
Don't Know	1	-	-	3.2	-	-
Deceased	-	2	-	-	6.5	-
Totals	31	29	2	100.0	100.0	

TABLE 100-A

RESPONSES OF SUBJECTS CONCERNING THE ATTITUDES OF PARENTS TOWARD GIRLS PURSUING CAREERS INVOLVING SCIENCE AND MATHEMATICS

SUBJECTS WHO DO NOT PREFER SCIENTIFIC CAREERS

	Mother	Father	Guardian	% Mother	% Father	% Guardian
For	16	16	-	40	40	-
Against	-	2	-	-	5	-
Uncertain	11	8	-	27.5	20	-
Don't Know	13	11	-	32.5	27.5	-
Deceased	-	3	-	-	7.5	-
Totals	40	40		100.0	100.0	

Levels of mechanical reasoning of the subjects who expressed a preference for careers involving science and mathematics and those who expressed a preference for other careers.--In order to ascertain whether or not the two groups of girls possess significantly different levels of mechanical reasoning, the data are presented and analyzed in the subsequent tables to follow.

Table 101 shows the distribution of the Mechanical Reasoning percentile of the science preference group and the non-science preference group, as well as the distribution of the total group.

Table 102 presents the statistical data. An analysis of Table 102 indicates the mean of the total group was 70.75 and the standard deviation 16. Although two-thirds of the expected frequency were

TABLE 101

FREQUENCY DISTRIBUTION OF THE MECHANICAL REASONING PERCENTILES OBTAINED BY SEVENTY-ONE SUBJECTS

Scores	Distribution Total	Science Preference Group	Non-Science Preference Group
95 - 99	5	3	2
90 - 94	7	5	2
85 - 89	4	3	1
80 - 84	5	2	3
75 - 79	12	7	5
70 - 74	6	2	4
65 - 69	3	1	2
60 - 64	10	4	6
55 - 59	6	1	5
50 - 54	7	1	6
45 - 49	2	1	1
40 - 44	2	1	1
35 - 39	1	-	1
30 - 34	1	-	1
Totals	71	31	40

between the score limits -1 sigma below the mean and +1 sigma above the mean; the observed frequencies were 46 cases between interval of scores 54. 75 - 86.75. Of the 71 subjects there were 33 cases above the mean and 32 cases below the mean.

Further analysis of Table 102 discloses the mean of the science preference group was 76.6, the standard deviation 15.2. Between -1

standard deviation below the mean and +1 standard deviation above the mean, the expected frequencies were 21. However, the frequencies noted between 61.4-91.8 were 24 cases. There were 13 cases above the mean and 18 cases below the mean. Of the 31 cases in the science preference group 20 were above the mean and 9 below the mean of the total group.

An examination of the data on the non-science group listed in Table 102 reveals that the mean of this group was 65.9, and the standard deviation 15.9. Although 27 cases were expected between the score limits -1 sigma below the mean and +1 sigma above the mean; the observed frequencies were 31 cases between the score interval 50.0-81.8. There were 17 cases above the mean and 21 cases below the mean. Of the 40 cases, about 13 were above the mean of the total group.

The critical ratio (Guilford's Z)value obtained points out that there was a significant difference between the mechanical reasoning of the science preference group and the non-science preference group.

Summary.--It has been established that:

1. The science-preference group made a better showing on comprehension of mechanical reasoning than the non-science group.
2. Although there was a significant difference between the mechanical reasoning of the two groups of girls, both groups were above the 65th mean centile in this area.

Levels of Comprehension of Space relations of the subjects who express a preference for science and mathematics careers and those who express preference in other areas.--In order to determine if there is a significant difference in the comprehension of spatial relations of the two groups of subjects, Tables 103 and 104 are presented and analyzed.

TABLE 102

STATISTICAL DATA DERIVED FROM MECHANICAL REASONING PERCENTILES OBTAINED BY SEVENTY-ONE SUBJECTS

Group	Number of Subjects	Mean	Standard Deviation	Standard error of Mean	D_M	D_M	Z
Science Preference Group	31	76.6	15.15	2.58	10.7	3.59	2.98*
Non-Science Preference Group	40	65.9	15.85	2.53			
Total	71	70.75	16	1.9			

*Significant at the .01 level

Table 103 was prepared to present the distribution of the Spatial Relations percentiles obtained by the seventy-one subjects and the two sub-groups.

TABLE 103

FREQUENCY DISTRIBUTION OF THE SPATIAL RELATIONS PERCENTILES OBTAINED BY SEVENTY-ONE SUBJECTS

Scores	Distribution Total	Science Preference Group	Non-Science Preference Group
95 - 99	8	6	2
90 - 94	8	5	3
85 - 89	6	5	1
80 - 84	2	1	1
75 - 79	10	2	8
70 - 74	8	5	3
65 - 69	8	1	7
60 - 64	7	1	6
55 - 59	6	2	4
50 - 54	6	2	4
45 - 49	1	1	0
40 - 44	1	0	1
Totals	71	31	40

Table 104 shows the statistical measures which were computed. An inspection of Table 104 indicates the mean centile of the group was 69.12 and the standard deviation 14.10. Between the score limits -1 standard deviation below the mean and +1 standard deviation above the mean, the

expected frequencies were approximately 68.26 per cent of the cases. However, the obtained frequencies actually were 47 cases between 55.02-83.22. Of the seventy-one subjects there were 42 cases above the mean and 21 cases below the mean.

Further examination of Table 104 identifies the mean centile of the science preference group as 79.5 with a standard deviation of 15. Between -1 sigma below the mean and + 1 sigma above the mean the expected frequencies were about two-thirds of the group, approximately 21; however the frequencies observed between the scores 64.5-94.5 were 25 cases. There were 17 cases above the mean and 14 cases below the mean. Of the 31 subjects in the science preference group 29 were above the mean of the total group.

Analysis of data in Table 104 shows the mean centile of the non-science group as 69.75 and the standard deviation 13. Between -1 sigma below the mean and + sigma above the mean, the expected frequencies were approximately 27. However, the frequencies observed between the scores 56.75-82.75 were 29 cases. There were 18 cases above the mean and 22 cases below the mean. Eighteen cases of the 40 subjects in the non-science group were above the mean of the total group.

With 69 degrees of freedom the required value of the critical ratio (Guilford's Z) at .01 level of confidence is 2.51. Therefore, the statistics indicate that there does not exist a significant difference between the comprehension of spatial relations of the two groups of girls.

Summary.--It has been found that:

1. As a group the seventy-one subjects possess a relatively fair degree of comprehension of spatial relations. Both groups were found to be above the 69 mean centile.

TABLE 104

STATISTICAL DATA DERIVED FROM THE SPATIAL RELATIONS PERCENTILES OBTAINED BY THE SEVENTY-ONE SUBJECTS

Group	Number of Subjects	Mean	Standard Deviation	Standard error of Mean	D_M	D_M	Z
Science Preference Group	31	79.5	15	2.77	9.75	0.83	2.51*
Non-Science Preference Group	40	69.75	13	2.09			
Totals	71	69.12	14.10	1.67			

*Statistically insignificant

2. Although there was a noticeable difference between the comprehension of spatial relations of the two groups of subjects, in favor of the science preference group, this difference was not significant.

Scientific occupational interest manifested by those who expressed a preference for science or mathematics as a career and those who expressed a preference for non-scientific careers.--Tables 105 and 106 are presented and analyzed to determine to what extent the two groups of subjects possess significantly different occupational interest.

Table 105 points out the distribution of raw scores of the scientific occupational interest of the subjects.

TABLE 105

DISTRIBUTION OF THE OCCUPATION INVENTORY RAW SCORES OBTAINED BY THE SEVENTY-ONE SUBJECTS

Scores	Distribution Total	Science Preference Group	Non-Science Preference Group
41 - 43	1	1	0
38 - 40	2	2	0
35 - 37	4	2	2
32 - 34	9	7	2
29 - 31	11	6	5
26 - 28	9	8	1
23 - 25	5	1	4
20 - 22	12	2	10
17 - 19	7	1	6
14 - 16	7	1	6
11 - 13	3	0	3
8 - 10	1	-	1
Totals	71	31	40

Table 106 shows the statistical data. An analysis of Table 106 indicates the mean of the group was 25.11 (80 percentile), and the standard deviation 7.05. Two-thirds of the expected frequencies -1 standard deviation below the mean and +1 standard deviation above the mean were found to be 47 cases; however, the observed frequencies were about 46 cases between the interval of scores 18.06-32.16 (40 percentile-80 percentile). Of the seventy-one subjects 36 cases were above the mean.

Further analysis of Table 106 shows the mean of the science preference group as 29.7 (90 percentile) and the standard deviation 5.92. Between -1 sigma below the mean and + 1 sigma above the mean the expected frequencies were 21 cases. The observed frequencies between the interval of scores 23.78-35.62 (70 percentile-90 percentile) were found to be 24 cases. There were 14 cases above the mean and 14 cases below the mean. Of the 31 subjects in the science preference group 26 scored above the mean of the total group.

With reference to the non-science preference group, Table 106 shows the mean to be 20.93 (50 percentile) and the standard deviation 6.84. Theoretically the expected frequencies for this group -1 sigma below the mean and +1 sigma above the mean were 27 cases, and the observed frequencies between the interval of scores 14.10-27.77 (30 percentile- 80 percentile) yield 27 cases. Seventeen cases scored above the mean and 18 cases scored below the mean. Of the 40 subjects in the non-science preference group, 10 scored above the mean of the total group.

The critical ratio indicates that there was a significant difference between the scientific occupational interest manifested by the group of subjects who expressed a preference for a career in science and the group who expressed a preference for a career in other areas.

TABLE 106

STATISTICAL DATA DERIVED FROM THE OCCUPATIONAL INVENTORY RAW SCORES OBTAINED BY THE SEVENTY-ONE SUBJECTS

Group	Number of Subjects	Mean	Standard Deviation	Standard error of Mean	D_M	D_M	Z
Science Preference Group	31	29.70	5.92	1.08			
Non-Science Preference Group	40	20.93	6.84	1.10	8.77	0.82	5.69*
Totals	71	25.11	7.05	0.85			

*Statistically significant at the .01 level

Summary.--The analysis of the data shows that:

1. Generally speaking the scientific occupational interest manifested by the total group was relatively high. (80 percentile)
2. The critical ratio reveals that there was a significant difference between the scientific occupational interest manifested by the two groups of girls. The science preference group manifested an extremely high occupational scientific interest (90 percentile), whereas the non-science preference group manifested relatively low scientific occupational interest (50 percentile).

Essential features of the home background of the subjects who expressed a preference for science or mathematics careers and those who do not express a preference for science or mathematics careers.--In order to ascertain if there is a significant difference between the essential features of the home background of the two groups of subjects the data are presented and analyzed in the tables which follow.

Tables 107 and 107-A present the distribution of the occupations of the mothers and fathers of the science preference group and non-science preference group respectfully. Tables 108 and 109 show the occupation of the mothers and fathers as classified into categories, rank, distribution number, and percentages. Table 110 points out the distribution of the occupations of the mothers and fathers of the two groups of subjects classified as professionals or non-professionals, and calculation of chi-square value. Table 111 describes the portrait of the educational factors of the mothers and fathers of the two groups of subjects.

Regarding the occupations of the parents of the two groups of

TABLE 107

DISTRIBUTION OF OCCUPATION OF PARENTS OF THE SCIENCE PREFERENCE GROUP

Mothers		Fathers	
Cashier	1	Brickmason	2
Clerk	1	Club Owner	1
Beautician	2	Coach Attendant (Railroad)	1
Housewife	10	Cook	1
Laboratory Technician	1	Counselor	1
Laundry Women	2	Dry Cleaner	1
Librarian	1	Janitor	2
Maid	2	Laborer	2
Sales Clerk	1	Leadman	1
Secretary	3	Machine Operator	1
Teacher	6	Mail Carrier	2
Waitress	1	Mechanic	1
		Minister	1
		Painter	1
		Postal Clerk	3
		Press Operator	1
		Principal	1
		Restaurant Owner	1
		Shipping Clerk	1
		Teacher	4
		Warehouseman	1
		Deceased	1
Total	31		31

TABLE 107-A

DISTRIBUTION OF OCCUPATIONS OF PARENTS OF THE NON-SCIENCE PREFERENCE GROUP

Mothers		Fathers	
Checker-Laundry	1	Baker	1
		Butcher	1
Cook	2	Cabinet Maker	1
		College President	1
Dietian	1	Construction Worker	1
		Factory Worker	1
Housewife	17	Interior Decorator	1
		Janitor	2
Librarian	1	Jewelry Salesman	1
		Leadman	1
Machine Operator	1	Laborer	2
		Mechanic	2
Maid	2	Metal worker	1
		Minister	2
Practical Nurse	2	Painter	1
		Plumber	1
Presser-Laundry	1	Porter	1
		Postal Clerk	7
Silk Finisher-Laundry	1	Social Worker	1
		Service Sta. Attend.	1
Secretary	1	Teacher	2
		Travel Agent Manager	1
Teacher	9	Warehouseman	1
		Deceased	4
Waitress	1	Restaurant Owner	2
Total	40		40

subjects, an examination of Table 108 reveals that there are more non-working mothers in the non-science preference group than in the science preference group. Of the working mothers in the science preference group, there are 26% professional and technical workers, 23% clerical workers, and 19% service workers as compared with 28% professional and technical workers, no clerical workers, and 25% service workers for the non-science preference group.

TABLE 108

STATISTICAL DATA DERIVED FROM THE OCCUPATIONS OF THE MOTHERS OF THE SEVENTY-ONE SUBJECTS

Category of Occupations	SCIENCE PREFERENCE GROUP			NON-SCIENCE PREFERENCE GROUP		
	Rank	Distribution Number	Per Cent	Rank	Distribution Number	Per Cent
Professional and Technical	1	8	25.80	1	11	27.50
Manager officials and Proprietors	2			2	1	2.50
Clerical Workers	3	7	22.58	3		
Sales Workers	4			4		
Craftsmen and Foreman	5			5	1	2.50
Operative Workers	6			6		
Service Workers	7	6	19.35	7	10	25.00
Laborers	8			8		
Housewives	0	10	32.25	0	17	42.50
Deceased	0			0		
Total		31			40	

An analysis of Table 109 shows that 45% of the fathers of the science group are in the upper three classes of occupations as compared with 40% of the non-science preference group. Further observation shows that there are 26% service workers in the science preference group and 13% service workers in the non-science group. The bulk of the remainding occupations of the fathers of the two groups fall in the class of craftsmen and foremen with 19% for the science group and 23% for the non-science group.

An inspection of Table 110 indicates that when the occupations of the fathers and mothers of the two groups were further classified into professionals and non-professional and chi-square computed there was found to be no significant difference between the occupational status of the parents of the subjects.

An examination of Table 111 points out that 27% of the fathers are college graduates with work on the graduate level. Almost three per cent hold doctors degrees. Twenty-eight per cent of the mothers are college graduates with work on the graduate level. Almost three per cent of them hold doctors degrees. In comparing the parents of the group who expressed a preference for science careers with the parents who expressed a preference for a career in other fields it was found that:

1. Mothers of the science preference group have an educational range of from some high school (9.7%) to finished professional, (12%). Mothers of the non-science preference group have an educational range of from elementary (5%) to holders of doctors degrees, (5%).
2. Thirty-five per cent of the mothers of the science preference

TABLE 109

STATISTICAL DATA DERIVED FROM THE OCCUPATIONS OF FATHERS OF THE SEVENTY-ONE SUBJECTS

	SCIENCE PREFERENCE GROUP			NON-SCIENCE PREFERENCE GROUP		
Category of Occupations	Rank	Distribution Number	Per Cent	Rank	Distribution Number	Per Cent
Professional and Technical	1	6	19.35	1	5	12.50
Manager officials and Proprietors	2	2	6.45	2	5	12.50
Clerical Workers	3	6	19.35	3	6	15.00
Sales Workers	4			4	1	2.50
Craftsmen and Foremen	5	6	19.35	5	9	22.50
Operative Workers	6			6	2	5.00
Service Workers	7	8	25.80	7	5	12.50
Laborers	8	2	6.45	8	3	7.50
Deceased	0	1	3.22	0	4	10.00
Total		31			40	

group are college graduates, with graduate work after college and 23% of the mothers of the non-science preference group are college graduates with graduate work after college.

3. The fathers of the science preference group have an educational range from some elementary (9.7%) to finished professional schools (9.7%). Fathers of the non-science preference group have an educational range from some elementary (10%), to holders of doctors degrees (5%).

4. Twenty-six per cent of the fathers of the science preference and 20% of the fathers of the non-science preference group are college graduates with graduate work after college.

TABLE 110

STATISTICAL DATA FROM THE DERIVED OCCUPATIONS OF MOTHERS AND FATHERS OF THE SEVENTY-ONE SUBJECTS GROUPED AS PROFESSIONALS OR NON-PROFESSIONALS

Science preference Group	Distribution	Non-science preference Group Distribution	Total
Mothers			
Professionals	8	11	19
Non-professionals	13	12	25
Totals	21	23	44
	Chi-square $x^2 = 0.371$		
Fathers			
Professionals	6	5	11
Non-professionals	24	31	55
Totals	30	36	66
	Chi-square $x^2 = 0.450$		

TABLE 111

STATISTICAL DATA DERIVED FROM THE EDUCATIONAL BACKGROUND OF THE PARENTS OF THE SEVENTY-ONE SUBJECTS

	SCIENCE				NON-SCIENCE				TOTAL			
	Mother	Per Cent	Father	Per Cent	Mother	Per Cent	Father	Per Cent	Mother	Per Cent	Father	Per Cent
Some Elemen.			3	9.7	2	5	4	10	2	2.8	7	9.8
Finished Elem.			1	3.2	1	2.5	3	7.5	1	1.4	4	5.6
Some H. S.	3	9.7	2	6.5	6	15	5	12.5	9	12.7	7	9.8
Finished H. S.	8	25.8	4	12.9	9	22.5	3	7.5	17	23.9	7	9.8
Some College	5	16.1	7	22.6	6	15	11	27.5	11	15.4	18	25.4
Finished Col.	6	19.3	5	16.1	3	7.5	3	7.5	9	12.7	8	11.3
Some Grad. Work	5	16.1	3	9.7	6	15	5	12.5	11	15.4	8	11.3
Finished Prof. School	4	12.9	3	9.7	3	7.5	2	5	7	9.8	5	7
Hold Doctors Degrees					(PhD.) 2	5	(PhD.) 2	5	2	2.87	2	2.87
Don't Know			3	9.7	2	5	2	5	2	2.87	5	7
Totals	31		31		40		40		71		71	

Summary.-- With reference to the essential home background features of the two groups of subjects it was found that:

1. There was no significant difference between the occupational status of the parents of the two groups of subjects.
2. The percentage indices show that there were not unusually wide gaps between the educational levels of the parents of the science preference group as compared with the parents of the non-science preference group.

CHAPTER III

SUMMARY AND CONCLUSIONS

Problem and Methodology.--America is becoming increasingly aware of the manpower and womanpower shortage of scientists, mathematicians, and engineers. For many years the only professions considered suitable for women were teaching and nursing. The traditional assumption, on the part of the general public, that the scientists' world is for men only and that the woman's place is in the home seems to have changed considerably. One of the growing trends in science and technology is the use of women in important positions. There are today women trained in physics, chemistry, geology, biology, and mathematics, who are successfully serving the United States in industry and research. The ability of women has been demonstrated and it is gradually being accepted that the woman's place is in the laboratory as well as in the home.

Although many girls possess the qualities needed for a science career, (strong curiosity, drive for independence, persistence, a good level of intelligence, and a strong background in which certain attitudes may be developed) few make a choice of science as a career. If interest could be aroused in the field of science at the high school level and girls encouraged to study the sciences, the United States might more nearly overcome its technological and scientific shortage.

One of the greatest obstacles in the way of education of women in scientific fields is the persistence of outmoded conceptions in the

minds of young girls, their parents, educators, vocational counselors and prospective employers. Some of these conceptions are: to study science is not womanly; that there is no cultural value in the study of the physical world in which we live; the sciences are a male preserve; and there are really no good opportunities for women in the scientific fields.

It is believed that this research may provide some means of identifying talented girls who may be guided to choose careers involving science and mathematics.

The central problem involved in this study was to test the null hypothesis that there are no differences in certain attitudinal and psychologic traits manifested by high school girls of above-average intelligence who prefer careers involving science and mathematics and those who do not.

The main purpose of this study was to attempt to discover whether relatively high degrees of mental and social traits or combinations of such traits manifested by a selected group of girls with above-average intelligence are useful in motivating them to express a preference for mathematics, science or mathematics-science related careers.

The specific purposes were to answer the following questions:

1. What are the attitudes of the subjects toward pursuing careers involving science and mathematics?
2. What do the subjects indicate about the attitude of their parents concerning girls pursuing careers involving science and mathematics?
3. Is there a difference in the levels of mechanical reasoning of the subjects who expressed a preference for careers which involve science and mathematics and those who express a

preference for other kinds of careers?

4. Is there a difference in the levels of comprehension of space relations of the subjects who express a preference for science careers and those who express a preference in other areas?
5. Is there a difference in scientific occupational interest manifested by those who express a preference for science or mathematics as a career and those who express a preference for non-scientific careers?
6. Is there a difference in the essential features of the home background of the subjects who express a preference for science or mathematics careers and those who do not express a preference for science or mathematics careers?
7. What are the implications of the present study for educational theory and practice?

For the purpose of clarity, the following terms have been defined:

1. "Attitude" - the concept of attitude accepted in this study is what the attitude scale "Attitudes Toward Science and Scientific Careers"[1] sought to measure.
2. "Manpower shortage" - refers to the imbalances between the demand for and the supply of particular kinds of workers.[2]
3. "Science and mathematics Careers" - refer to those technological careers involving strong academic preparation in the physical sciences such as chemistry, physics, mathematics, and

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[1] Hugh Allen, Jr., op.cit., pp. 43-52.

[2] National Manpower Council, op. cit., p. 225.

biology.

4. "Space relations and mechanical reasoning" - relate to the students' abilities to visualize concrete objects and manipulate those visualizations and to recognize everyday physical forces and principles.[1]

The features of the locale and research design of this study are indicated below:

1. Locale.-- This study was conducted in a Southeastern Metropolitan School System during the second semester of the 1960-61 school term.
2. Subjects.-- The subjects of this study were a group of eighth, ninth, tenth, eleventh, and twelfth grade girls whose I. Q.'s are 110 and above, who were enrolled in a Metropolitan Southeastern Public School System.
3. Research Method.--The Descriptive-Survey Method of research, employing the specific techniques of testing and the use of the questionnaire, was used to gather and interpret the data necessary for the completion of the study.
4. Instruments.-- The instruments used in this study were: (a) Attitude Toward Science and Scientific Careers,[2] Bennett Seashore Wesman Mechanical Reasoning Test, Form A,[3] (c) Bennett Seashore Wesman Space Relations Test, Form A,[4] (d) Lee and

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[1]George K. Bennett, et al., op. cit., p. 5.

[2]Attitudes Toward Science and Scientific Careers, op. cit.

[3]Bennett, Seashore and Wesman Mechanical Reasoning Test, op. cit.

[4]Bennett, Seashore, and Wesman Spatial Relations Test, op. cit.

Thorpe Occupational Inventory,[1] (e) Otis Quick Scoring Mental Ability Test,[2] (f) Special Questionnaire.

4. Operational Steps.--The operational steps for this research were as follows:

   a. The related literature pertinent to this study was reviewed, summarized, and embodied in this thesis.

   b. Permission to do this study was secured from the proper school authorities.

   c. The subjects for this study were chosen from the eighth, ninth, tenth, eleventh, and twelfth grade girls whose I. Q.'s are 110 and above enrolled in the selected school system.

   d. The test and questionnaires used in this study were administered on designated testing days.

   e. The data derived from the questionnaires and tests were assembled into appropriate tables which constituted the basis for the analysis, interpretation, and the evaluation of the specific purposes of the research.

   f. The main statistical measures used in the analysis and interpretation of the data were frequency distribution, mean, standard deviation, standard error of the mean, critical ratio test (Z), chi-square values, and percentage indices.

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[1] Lee and Thorpe Occupational Inventory, Adv. Form A., op. cit.

[2] Otis Quick Scoring Mental Ability Test, op. cit.

g. The report of the findings, conclusions, implications, and recommendations derived from the analysis and interpretation of the data are incorporated in the complete thesis copy.

Summary of Literature Pertinent to the Present Study.--The literature pertinent to this study was reviewed under the following captions: (1) Qualities needed for careers in science; (2) The extent of women's education in science and mathematics; (3) Achievement of women in science careers; (4) Job opportunities for women; and, (5) Previous research studies.

Regarding qualities needed for careers in science, Pollack,[1] Robinson,[2] Nourse,[3] Zapoleon,[4] Brandewein,[5] Rankin,[6] Seaborg[7] argue for certain specific qualities such as good health, imagination, and mental alertness. All seem to be in agreement that the qualities necessary for success in scientific and technological areas are: having a superior intelligence; being logical and objective; being accurate in observations; and having the ability and willingness to work hard.

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[1]Philip Pollack, op. cit.

[2]H. Alan Robinson, op. cit.

[3]Alan Nourse, op. cit.

[4]Marguerite Zapoleon, op. cit.

[5]Paul F. Brandwein, op. cit.

[6]Betty Lou Rankin, op. cit.

[7]The Atlanta Journal, op. cit.

Concerning the extent of women's education in science and mathematics, analysis of the statistical data indicated that, while there is admittedly and obviously a paucity of women pursuing scientific and technological training; there is a tendency for women to enter these heretofore neglected areas.

Referring to achievement, many women have been able to overcome social cultural resistence of entry into scientific careers and have obtained outstanding achievements and many honors.

Concerning job opportunities, various governmental, industrial and other employment agencies are aware of the need to tap the vital resources for science and science related careers. As the horizon of job opportunities for women widens more concern will be given to qualifications, training and experience than will be given to the sex of the prospective employee.

As a result of previous research studies it is increasingly possible to identify those with potential for science and science related careers on the secondary level.

Finkel made a study of the factors affecting the high school student's choice regarding a science career. His findings revealed that the primary reasons the students did not take more science in high school were:

1. Science was too difficult and involved too much mathematics.
2. Elementary science courses had been poorly taught and were uninteresting.
3. The school offered so many important desirable courses in competition that students do not select science.[1]

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[1]U. S. Dept. of Health, Education and Welfare, Bul. No. 7, op. cit.

Stice, Torgerson, and Mollenkope, made a study of high school students and their plans. Their conclusions were: (1) Economic and cultural determinism exist in connection with going to college; (2) More scholarships are needed; (3) Higher education is losing one-half of the top 30% of high school seniors; (4) Lack of interest and funds have equal weight in causing the loss.[1]

Brandwein reported that a potential scientist may be identified by a training program (operational approach), or he may be identified by a testing program.[2]

Allen made a study of a selected group of high school seniors to attempt to investigate attitudes toward science and scientific careers. An analysis of his data indicated that intelligence of the high school senior is related to his attitudes regarding science and scientific endeavor. The higher the intelligence the greater the degree of constructive attitudes toward scientific enterprises.[3]

Summary of the Findings.--A resume of the findings of the research is presented in the paragraphs which follow:

Attitudes.-- The subjects possess positive constructive attitudes toward scientific endeavors. Chi-square value shows no significant differences between the responses on the attitude scale between the science preference group and the non-science preference group. The analysis of the data presented in Chapter II shows that:

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[1] Ibid., p. 16.

[2] Paul F. Brandwein, op. cit.

[3] Hugh Allen, Jr., op. cit.

1. The subjects have an understanding of science's impact on society and society's impact on science.
2. The subjects have a favorable "image" of the scientist. They expressed the opinion that they do not consider the scientist a magician, "an egg head," "a long hair," an "odd lot," shy, lonely, nor communistic.
3. They have an understanding of scientific work and of the nature of science. They realize that scientific work require high ability, long years of labor, self discipline, creativity, and a strong mathematical background.
4. The subjects possess strong personal attitudes. They feel that for them training in science is worth the time and effort that they have the intelligence for successful scientific enterprises. They rejected the man made theory that science is a man's world.
5. The percentage indices indicated that there was a noticeable difference between the two groups of girls about what they feel the attitudes of their parents would be concerning girls pursuing careers involving science and mathematics. Of the thirty-one girls in the science preference group, 94% expressed the opinion that their mothers would not object to girls making a choice of science careers, and 74% hold the opinion that their fathers would not object. Of the forty subjects in the non-science group 40% indicated that their mothers were in favor of girls selecting science careers, and 40% felt that their fathers would not object. The non-science preference group expressed a greater degree of uncertainty about how

their parents would feel about girls pursuing scientific careers and entered "don't know" as an answer more frequently than did the science preference group.

In mechanical reasoning both groups of girls were above the 65th mean centile. The science preference group made a better showing than did the non-science preference group. With 69 degrees of freedom at the .01 level of confidence the critical ratio revealed a significant difference between the two groups in mechanical reasoning.

As a group, the seventy-one subjects possess a relatively high degree of comprehension of spatial relations. Both groups of subjects were found to be above the 69th centile. Both groups possess a relatively high degree of comprehension of spatial relations. Although there was a noticeable difference between the comprehension of spatial relations of the two groups of girls the critical ratio indicated that the difference was not significant.

The scientific occupational interest manifested by the total group was high (80 percentile). The science preference group manifested an extremely high occupational scientific interest (90 percentile) whereas the non-science preference group manifested low scientific occupational interest (50 percentile). The critical ratio showed a significant difference between the occupational interest manifested by the two groups of subjects.

When chi-square value was applied to the data concerning the essential features of the home background of the subjects, it showed no significant difference between the occupational status of the parents of the two groups. There were teachers, ministers, social workers, clerks, laborers, janitors, etc., distributed in both groups; however, there were

more non-working mothers among the non-science group than there were among the science preference group. With reference to the educational background of parents more than 25% of the mothers and fathers of the seventy-one subjects are college graduates with work on the graduate level. Thirty-five per cent of the mothers and 26% of the fathers of the science preference group are college graduates with work on the graduate level. Twenty-three per cent of the mothers and 20% of the fathers of the non-science preference group are college graduates with work on the graduate level. The percentage indices seem to indicate that there were not unusually wide gaps between the educational levels of the parents of the science preference group as compared with the parents of the non-science preference group.

Conclusions.--The following are conclusions in light of the findings of this study:

1. High school girls with above-average intelligence manifest positively constructive attitudes toward science and scientific careers, and there are no attitudinal differences between those who express a preference for scientific careers and those who do not.
2. A greater percentage of the science preference group indicated the belief that neither their mothers nor their fathers would object to girls pursuing scientific careers than did the non-science group.
3. There was a significant difference in the level of mechanical reasoning between the group who expressed a preference for science careers and those who expressed career preferences in other areas in favor of the former.

4. There was no significant difference in the level of comprehension of spatial relations between the science preference group and the non-science preference group.

5. There was a significant difference in the occupational interest of the group of girls who expressed a preference for science endeavors and the group of girls who expressed a preference for other kinds of careers.

6. There was no difference in the essential features of the home backgrounds of the girls who expressed a preference for science careers and those who did not.

7. High school girls with above average intelligence, high levels of mechanical reasoning; comprehension of spatial relations; interest in scientific occupations; and a preference for scientific careers should be provided with a more positive kind of enrichment program that would motivate them to prepare for entrance into science or science related careers.

Recommendations.--The following recommendations grew out of this study:

1. The high level ability girl interested in a science or science-related career should be identified as early as possible in high school.

2. The school should provide the identified girl with the highest calibre of preparation. Preparation for science or technological careers should include four years of science courses (chemistry, physics, biology and an elective senior science); four years of mathematics (algebra, plane geometry, elementary functions, topics in elementary calculus, probability and

statistical inference); a background study in English, foreign language, social studies; and a course in technical drawing.

3. The identified girl should be provided with an enrichment program at home, at school, and in the community designed to increase motivation, interest, desire, and inspiration to enter a science or science-related career. Some activities recommended for a prospective scientist are enrollment in study programs for high school science students offered by universities during the summer months; visits to laboratories and scientific departments of all kinds; participation in cooperative work-training and apprentice enterprises supported by local community groups during summer months; engage in extensive reading of scientific literature.
4. The potential girl scientist should be made aware of her acceptance in science and technological areas by providing experiences and information on achievements of outstanding women already engaging in science careers as well as information about job opportunities and employment.
5. Special science honors and scholarships should be set up especially for girls to motivate them in making a selection of science or science-related careers.
6. Guidance workers and science teachers should conscientiously and consistently work to eliminate factors which would tend to perpetuate misconceptions which tend to cause above-average girls from choosing science and/or science-related careers.

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APPENDIX A

ATTITUDES TOWARD SCIENCE AND SCIENTIFIC CAREERS

A REACTION INVENTORY FOR NEW JERSEY HIGH SCHOOL SENIORS*

SECTION I--Personal Data

Instructions: The data you give here is CONFIDENTIAL and will be seen only by the investigator. Fill in the requested information as completely and accurately as possible, for all of it will be needed for analyses.

1. Name_____ 2. Age____

3. Sex____(check) ( ) Boy ( ) Girl 4. Name of School_____

_____ 5. How many brothers and sisters do you have?_____

6. What is your father's occupation? (i.e. What does he do? Be specific--describe the work he does.) (If deceased, what did he do?)

_____

7. In what industry is (or was) your father employed? (Be specific--describe what they do at his place of employment.)_____

_____

8. How much formal schooling did your father have? (check one)

( ) Some elementary school	( ) Finished college
( ) Finished elementary school	( ) Some graduate work after college
( ) Some high school	( ) Finished Prof. school
( ) Finished high school	( ) Holds doctor's degree
( ) Some college	( ) Don't know

9. What is your mother's occupation? (i.e. What does she do? Be specific--describe the work she does.) (If deceased, what did she do? If she is a housewife, so state.)_____

_____

10. In what industry is (or was) your mother employed? (Be specific--describe what they do at her place of employment.) _____

_____

11. How much formal schooling did your mother have? (check one)

( ) Some Elementary School
( ) Finished elementary school
( ) Some high school
( ) Finished high school
( ) Some college
( ) Finished college
( ) Some grad. work after college
( ) Finished professional school
( ) Holds doctor's degree
( ) Don't know

12. In what quarter of your class do you stand on the basis of your high school grades? (check one)

( ) In the highest quarter of your class
( ) In the upper middle quarter of your class
( ) In the lower middle quarter of your class
( ) In the lowest quarter of your class

13. What science courses have you taken (or are you taking) in high school? (Specify the number of years--If only one semester, specify ½ year.)

( ) General Science
( ) Biology
( ) Chemistry
( ) Physics
( ) Other (specify)_____
( ) Other (specify)_____
( ) Other (specify)_____
( ) Other (specify)_____

14. What mathematics courses have you taken (or are you taking) in high school? (specify the number of years--If only one semester, specify ½ year.)

( ) General Math
( ) Elementary Algebra
( ) Intermediate Algebra
( ) Advanced Algebra
( ) Plane Geometry
( ) Solid Geometry
( ) Plane Trigonometry
( ) Calculus
( ) Other (Specify)_____
( ) Other (Specify)_____

15. Which high school subject taken (or being taken) did you like most? Why?_____

16. Which high school subject taken (or being taken) did you like least? Why?_____

17. In which high school subject do you get your best grades?_____ What is the highest semester (or term) grade you ever made in that subject?

_____

18. In which high school subject do you get your lowest grades?_____ What is the lowest semester (or term) grade you ever made in that subject?_____

19. If you have taken (or are taking) a science course (or courses), check your reason (or reasons) for doing so below.

( ) It is required for high school graduation.
( ) I like science.
( ) I need science for college entrance
( ) I plan a career in which science is necessary.
( ) I think every good citizen should know science.
( ) Other reason. (Specify)_____
( ) Other reason. (Specify)_____

20. If you have taken (or are taking) a mathematics course (or courses), check your reason (or reasons) for doing so below.

( ) It is required for high school graduation.
( ) I like math.
( ) I need math for college entrance.
( ) I plan a career in which math is necessary.
( ) I think every good citizen should know math.
( ) Other reason. (specify)_____
( ) Other reason. (specify)_____

21. What kind of occupation do you want to go into as an adult? (Be specific--i.e. What is your first choice?)_____

22. Will it be possible for you to prepare for the occupation named in Question 21? (Check one) ( ) Yes ( ) No. If your answer is NO, why not?_____

23. Would you be interested in becoming a scientist? (for example: a chemist, psychologist, physicist, physiologist, pathologist, or astronomer.)
( ) Yes ( ) No ( ) Undecided. (check one)

24. Would you be interested in becoming an engineer? (for example: electrical, mechanical, civil, or chemical engineer.)
( ) Yes ( ) No ( ) Undecided. (check one)

25. If you are not thinking about a career in science or engineering, which of the following have something to do with it? Check all statements that pertain.

( ) I am more interested in another career.
( ) Science is too difficult for me.
( ) Mathematics is too difficult for me.
( ) Scientists are peculiar people, and I don't want to be like them.
( ) You can't make much money as a scientist or engineer.
( ) Other reason. (Please state)_____
( ) Other reason. (Please state)_____

26. If you have had firsthand experiences with scientists, have these experiences changed your ideas about them? (check one)

( ) I've gotten a more favorable idea of them.
( ) I've gotten a less favorable idea of them.
( ) I've had no firsthand experiences with scientists.

27. Do you consider the person who analyzes blood samples in a laboratory to be a scientist? ( ) Yes ( ) No. (Check one)

Questions 28 and 29 for Girls only:

28. Would you be hesitant to go into scientific work where men are favored? ( ) Yes ( ) No. (check one)

29. Indicate your first, second, and third choices for the occupation of the man you'd most like to marry. (Place 1, 2, or 3 in the appropriate box to indicate your first, second, and third choices)

( )	Physician	( )	Psychologist
( )	Chemist	( )	Atomic Scientist
( )	Electrical Engineer	( )	Lawyer
( )	High School Sci. Teacher	( )	Professor of Science (College or University)
( )	Mechanic	( )	Biologist
( )	Sales Clerk	( )	Entertainer (Radio or TV)
( )	Minister or Rabbi	( )	Other (specify)_____
( )	Others (specify)_____		

SECTION II Attitude Scale

Instructions: Please give your reactions to the following list of statements regarding science, scientists, and scientific careers. Work rapidly. Record your first impression--the feeling that comes to mind as you read the item

Draw a circle around AA if you completely agree with item.
Draw a circle around A if you are in partial agreement.
Draw a circle around N if you are neutral.
Draw a circle around D if you partially disagree.
Draw a circle around DD if you totally disagree.

Example:

AA (A) N D DD 100. In the springtime Paris is more beautiful than New York. (Since A is circled, this indicates that you are in slight agreement.)

AA A N D DD 1. Science is not sufficiently appreciated by most people.

AA A N D DD 2. Science is a systematic way of thinking.

AA A N D DD 3. Scientists are seldom concerned with their working conditions.

AA A N D DD 4. The development of new ideas is the scientist's greatest source of satisfaction.

AA A N D DD 5. Friends often discourage girls from taking high school Science courses.

AA A N D DD 6. Science and technology are essential to the development of present-day cultures.

AA A N D DD 7. Increased radiation resulting from bomb tests is a threat to civilization.

AA A N D DD 8. Scientists are too narrow in their views.

AA A N D DD 9. Industries use research as a means to improve their economic position.

AA A N D DD 10. The application of scientific knowledge to the development of new industries enriches society.

AA A N D DD 11. The President's cabinet should be enlarged to include a Secretary of Science.

AA A N D DD 12. Scientists and engineers should be eliminated from the military draft.

AA A N D DD 13. The scientist will make his maximum contribution to society when he has freedom to work on problems which interest him.

AA A N D DD 14. A scientist might aptly be described as a nonconformist.

AA A N D DD 15. Scientist should be looked upon as "subjects for suspicion."

AA A N D DD 16. Scientific investigations are undertaken as a means of achieving economic gains.

AA A N D DD 17. To become a scientist requires superior ability.

AA A N D DD 18. Science requires creative activity.

AA A N D DD 19. Scientists are willing to change their ideas and beliefs when confronted by new evidence.

AA A N D DD 20. Scientists have unusually intelligent mothers.

AA A N D DD 21. Scientists are "longhairs."

AA A N D DD 22. The complexity of science hides its cultural values.

AA A N D DD 23. MODERN science is too complicated for the average citizen to understand and appreciate.

AA A N D DD 24. Scientist possess too much power in our society.

AA A N D DD 25. Decisive economic, political, and social processes are greatly influenced by science.

AA A N D DD 26. It is undemocratic to favor exceptional scientific talent.

AA A N D DD 27. The monetary compensation of a Nobel Prize winner in Physics should be at least equal to that given popular entertainers.

AA A N D DD 28. Hazards created by the increased use of radioactive materials make scientific work less attractive than previously.

AA A N D DD 29. Scientists are shy, lonely individuals.

AA A N D DD 30. Loyalty checks and security clearances have seriously interfered with the work of scientists.

AA A N D DD 31. For me, training for a career in science is not worth the time and effort required.

AA A N D DD 32. Science is primarily a method for inventing new devices.

AA A N D DD 33. Scientists are more emotional than other people.

AA A N D DD 34. Girls have very little mechanical aptitude, and therefore should not consider scientific careers.

AA A N D DD 35. Scientists are honored persons who stand very high in popular prestige.

AA A N D DD 36. To appreciate modern society fully, a person must understand the importance of science.

AA A N D DD 37. Scientists are an "odd" lot.

AA A N D DD 38. Science without mathematics is impossible.

AA A N D DD 39. Science is the greatest unifying force among nations.

AA A N D DD 40. Maintenance of scientific work is essential to national survival.

AA A N D DD 41. The use of scientific achievements is often hampered by selfish individuals.

AA A N D DD 42. Scientific work is boring.

AA A N D DD 43. Scientific activity is greatly influenced by culture.

AA A N D DD 44. The free flow of scientific information among scientists is essential to scientific progress.

AA A N D DD 45. Scientists display an almost irrational attachment to their work.

AA A N D DD 46. I don't have the intelligence for a successful scientific career.

AA A N D DD 47. The winning of the esteem of his associates is one of the main incentives for the scientist.

AA A N D DD 48. Scientific findings always lead to final truths.

AA A N D DD 49. Scientists are as concerned as are other groups with the policies of the company for which they work.

AA A N D DD 50. Industrial developments are based more on practical experience than on laboratory research.

AA A N D DD 51. The scientist can expect to accumulate little wealth as compensation for his work.

AA A N D DD 52. Science is a man's world: there is little room in it for women.

AA A N D DD 53. Science is primarily responsible for the frequent changes which occur in our manner of living.

AA A N D DD 54. Scientists are "eggheads."

AA A N D DD 55. Scientific work requires long years of labor and self-discipline.

AA A N D DD 56. A great research scientist is little concerned with the practical applications of his work.

AA A N D DD 57. Scientists are communistic.

AA A N D DD 58. Science is an attitude toward life and environment.

AA A N D DD 59. OUR foremost scientists are primarily concerned with their own thoughts and ideas.

AA A N D DD 60. Science has done little for the average citizen.

AA A N D DD 61. Scientific truths are usually found by persons seeking economic gain.

AA A N D DD 62. The neglect of basic scientific research would be the equivalent of "killing the goose that laid the golden eggs."

AA A N D DD 63. Science receives too little serious attention in the mass media.

AA A N D DD 64. Scientists today are subject to too many governmental restrictions.

AA A N D DD 65. The engineer serves a more practical purpose in society than does the research scientist.

AA A N D DD 66. There is much self-satisfaction to be received from work as a scientist.

AA A N D DD 67. A scientist's life is full of adventure.

AA A N D DD 68. The average American home discourages girls from scientific careers.

AA A N D DD 69. Universities do little scientific research that is of immediate practical value.

AA A N D DD 70. Scientists do not need the physical stamina necessary for most other work.

AA A N D DD 71. Science helps us to understand our environment.

AA A N D DD 72. Scientific concepts and discoveries often bring about new sociological problems.

AA A N D DD 73. Scientists are against formal religion.

AA A N D DD 75. "Practical" politicians and business men disregard the advice of scientists.

AA A N D DD 75. Scientists often have physical deformities which render them unfit for other work.

AA A N D DD 76. Science and its inventions have caused more harm than good.

AA A N D DD 77. The social environment of the United States is hostile to the development of scientific talent.

AA A N D DD 78. One cannot have a normal family life and be a scientist.

AA A N D DD 79. The bulk of scientific research is carried on by devoted men and women without regard for their personal living or social relations.

AA A N D DD 80. Public interest in science is essential to the maintenance of scientific research.

AA A N D DD 81. Most of the basic scientific research done in our country is carried on by industry.

AA A N D DD 82. Many specific findings in science contradict the laws of God.

AA A N D DD 83. American scientists are largely responsible for our country's status among nations.

AA A N D DD 84. Scientists are essentially magicians, making two blades of grass where one grew before.

AA A N D DD 85. Industrial research is often carried on by teams of scientific workers.

AA A N D DD 86. Scientific work is monotonous.

AA A N D DD 87. The working scientist believes that nature is orderly rather than disorderly.

AA A N D DD 88. The modern world is dominated by science.

AA A N D DD 89. Scientists as a group are often condemned for the unpopular ideas and activities of a few fellow workers.

AA A N D DD 90. Scientists are often willing to sacrifice the welfare of others to further their own interests.

AA A N D DD 91. Scientists are usually unsociable.

AA A N D DD 92. Curiosity motivates scientists to make their discoveries.

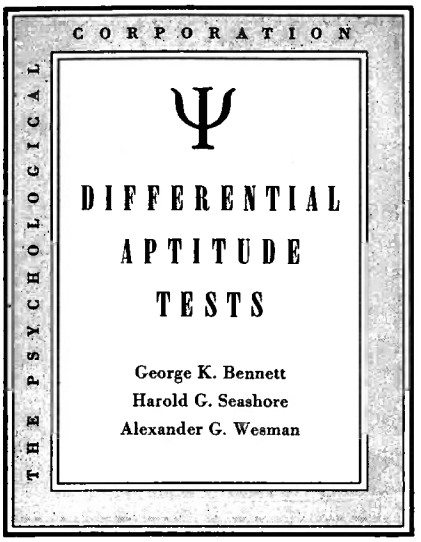
AA A N D DD 93. The chief reward in scientific work is the thrill of discovery.

AA A N D DD 94. In high school, boys receive more encouragement to take science courses than do girls.

AA A N D DD 95. Americans place greater value on the practical applications of scientific discoveries than on the discoveries themselves.

Please indicate below, by checking in the appropriate space, the attitude of your parents concerning your choosing a career which would involve science and mathematics.

	MOTHER	FATHER	GUARDIAN
For	_____	_____	_____
Against	_____	_____	_____
Uncertain	_____	_____	_____
Don't know	_____	_____	_____



MECHANICAL REASONING

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, print your name, address, and other requested information in the proper spaces.

In the space after **Form,** print an **A.**

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET

Printed in U.S.A.
Ψ Reg. U.S. Pat. Off.

57-229 TB

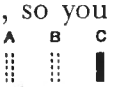
Do not make any marks in this booklet

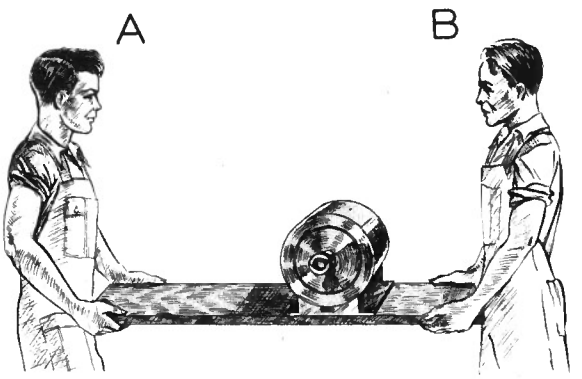
Mark your answers on the separate Answer Sheet

MECHANICAL REASONING

DIRECTIONS

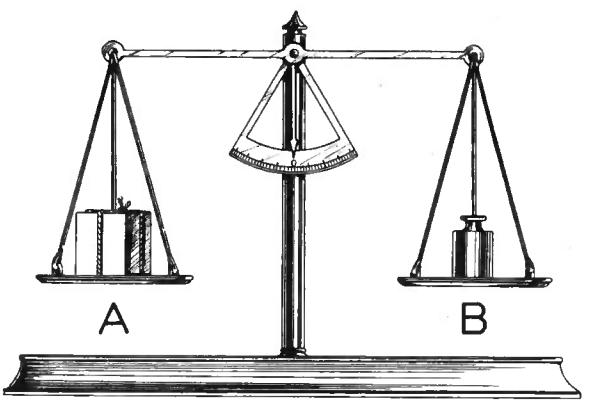
This test consists of a number of pictures and questions about those pictures. Look at Example X on this page to see just what to do. Example X shows a picture of two men carrying a machine part on a board and asks, "Which man has the heavier load? If equal, mark C." Man "B" has the heavier load because the weight is closer to him than to man "A," so on the separate Answer Sheet you would fill in the space under B, like this → 

Now look at Example Y. The question asks, "Which weighs more? If equal, mark C." As the scale is perfectly balanced, "A" and "B" must weigh the same, so you would blacken the space under C on your separate Answer Sheet, like this → 



X

Which man has the heavier load?
(If equal, mark C.)



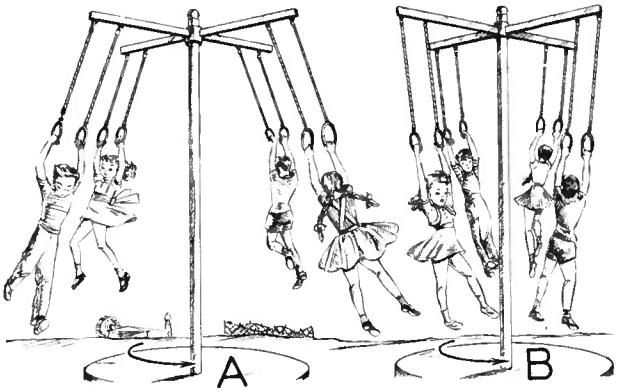
Y

Which weighs more?
(If equal, mark C.)

On the following pages there are more pictures and questions. Read each question carefully, look at the picture, and mark your answer on the separate Answer Sheet. Do not forget that there is a third choice for every question.

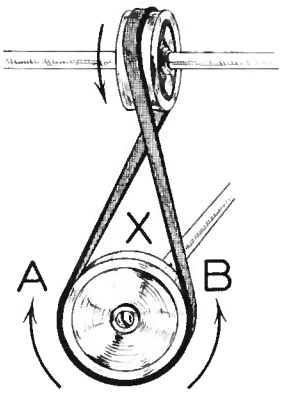
DO NOT TURN OVER THE BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Drawings by Helen Gabryel



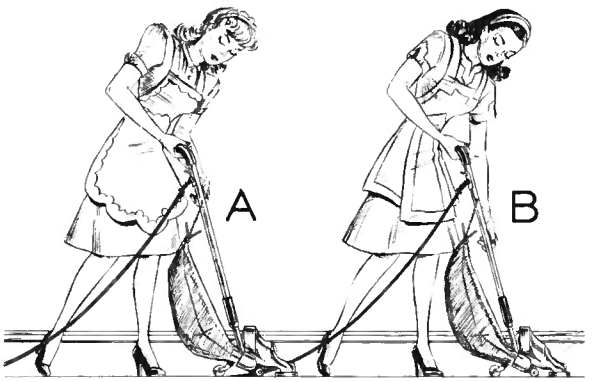
1

In which picture are the children whirling faster?
(If equal, mark C.)



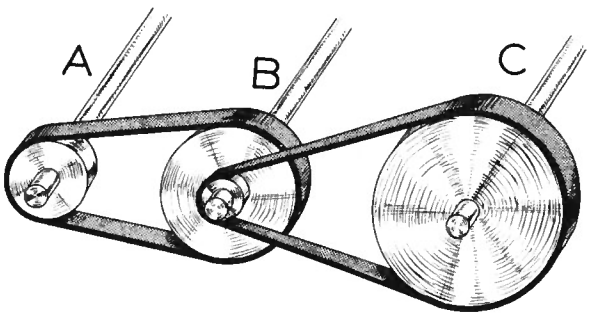
2

When the top pulley turns in the direction shown, which way will the lower pulley turn?
(If either, mark C.)



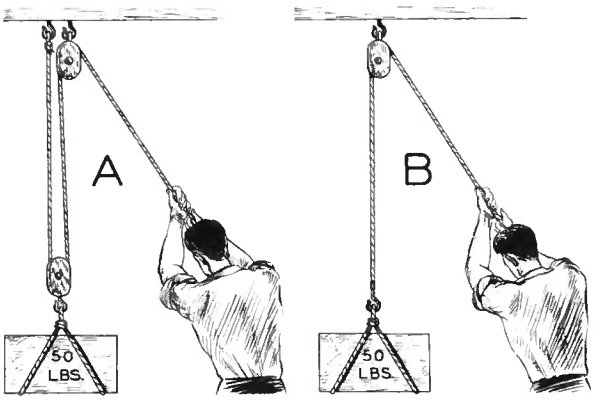
3

Which girl can lift the cleaner more easily?
(If equal, mark C.)



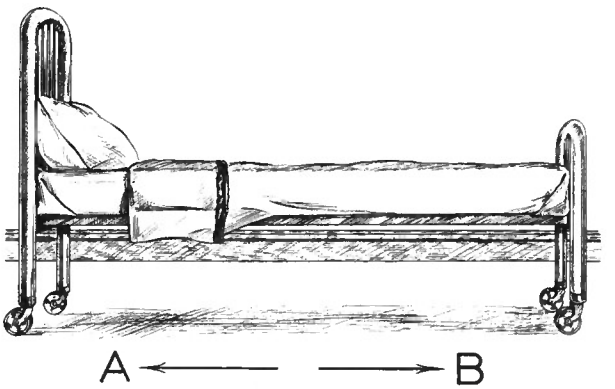
4

Which shaft will turn most slowly?



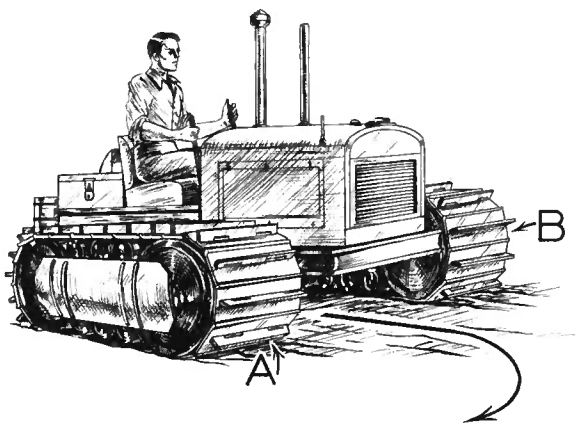
5

Which man must pull harder to lift the weight?
(If equal, mark C.)



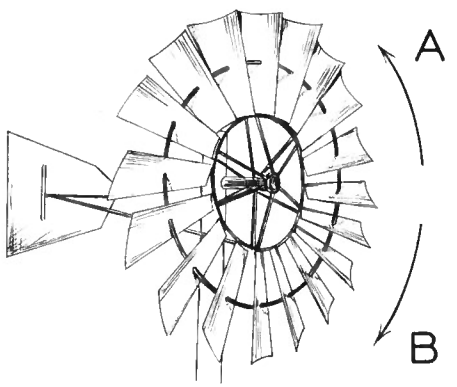
6

Which way has this bed just been rolled?
(If either, mark C.)



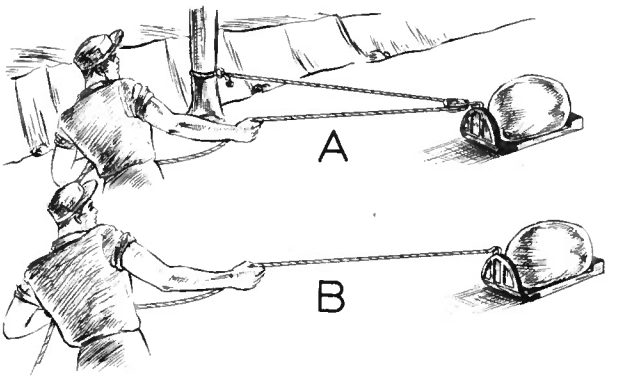
7

Which tread should move more slowly for the tractor to turn in the direction shown?
(If neither, mark C.)



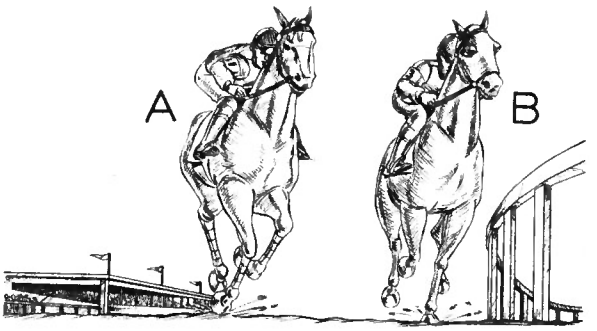
8

In which direction is this windmill more likely to turn?
(If either, mark C.)



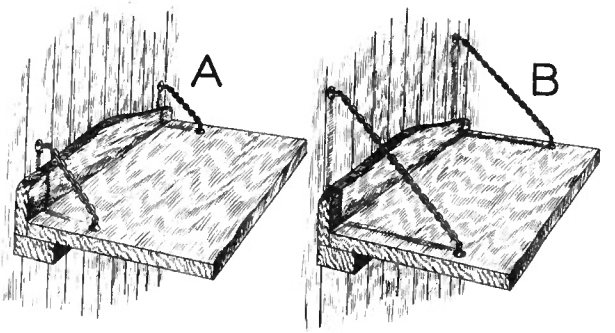
9

Which man has to pull harder?
(If equal, mark C.)



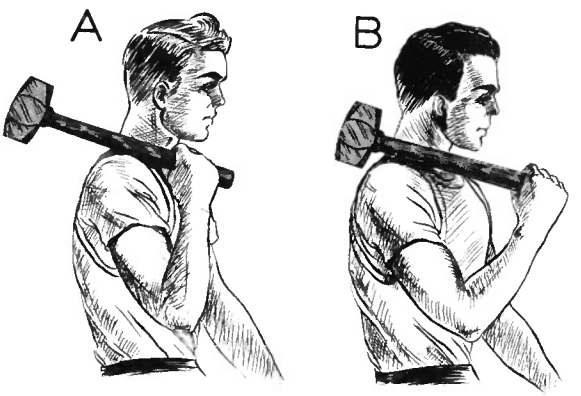
10

Which horse must go faster to hold his place on the turn?
(If equal, mark C.)



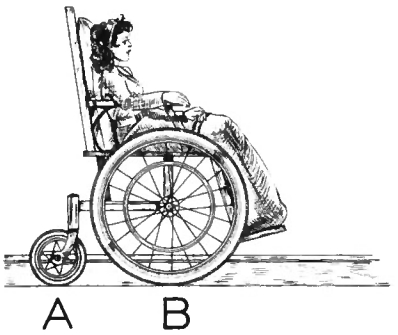
11

Which shelf is stronger?
(If equal, mark C.)



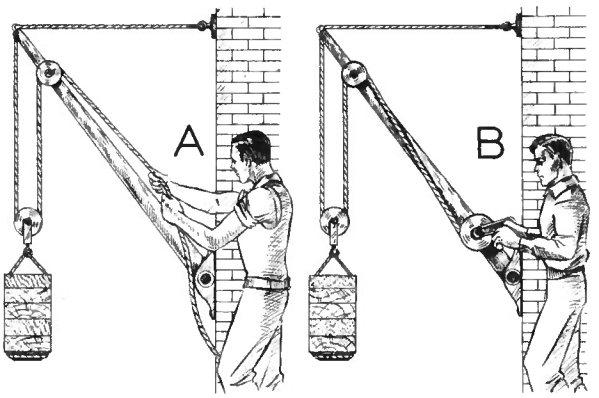
12

Which is the harder way to carry the hammer?
(If equal, mark C.)



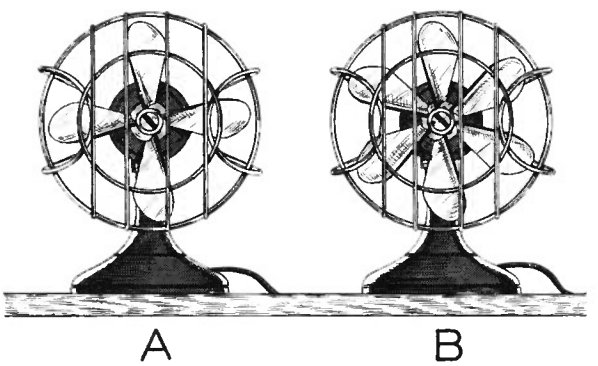
13

Which wheel will turn faster?
(If equal, mark C.)



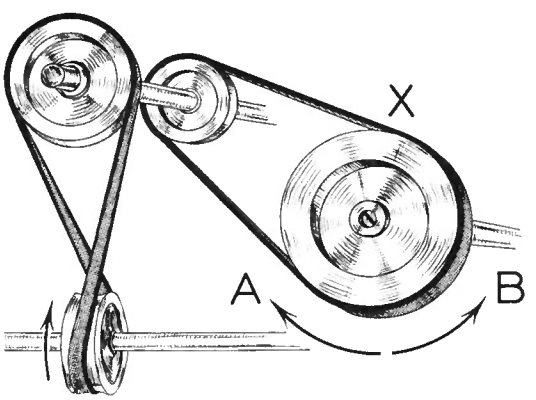
14

Which man can lift the weight more easily?
(If equal, mark C.)



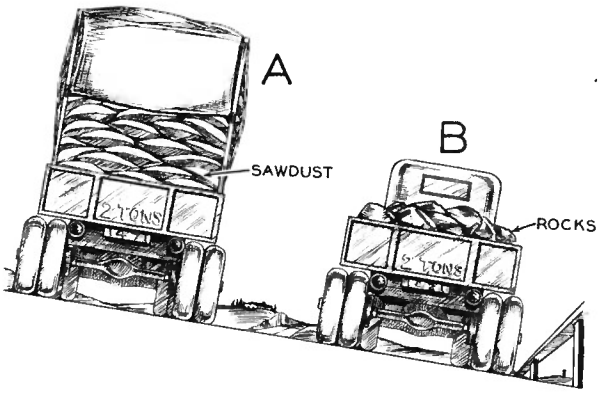
15

Which fan needs the more powerful motor?
(If equal, mark C.)



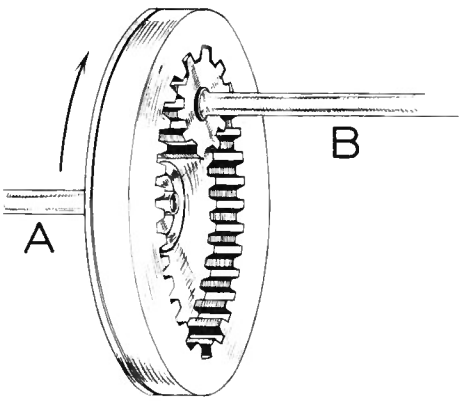
16

Which way will pulley "X" turn?
(If either, mark C.)



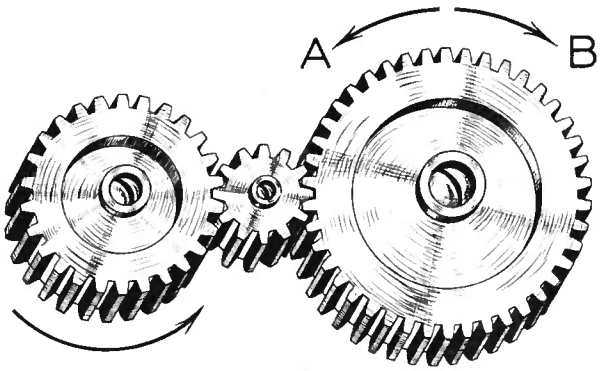
17

Which truck will turn over more easily?
(If equal, mark C.)



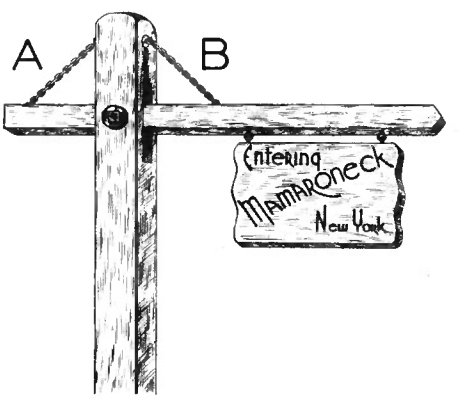
18

Which shaft turns faster?
(If equal, mark C.)



19

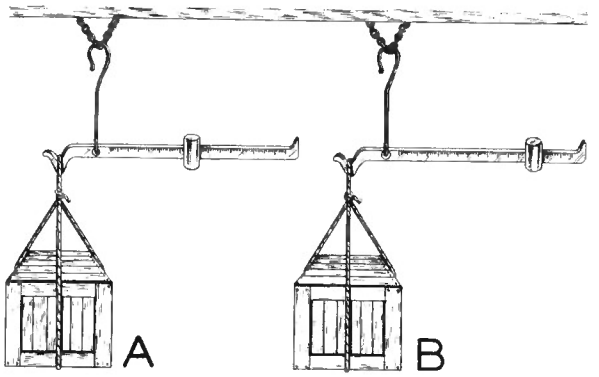
When the left-hand gear turns in the direction shown, which way does the right-hand one turn?
(If either, mark C.)



20

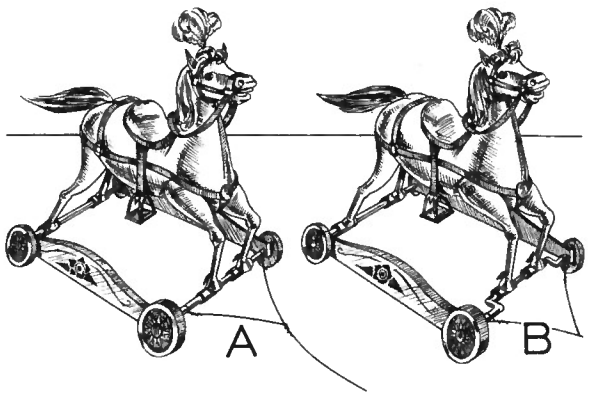
Which chain alone will hold up the sign?
(If either, mark C.)

PUT YOUR ANSWERS ON THE ANSWER SHEET.



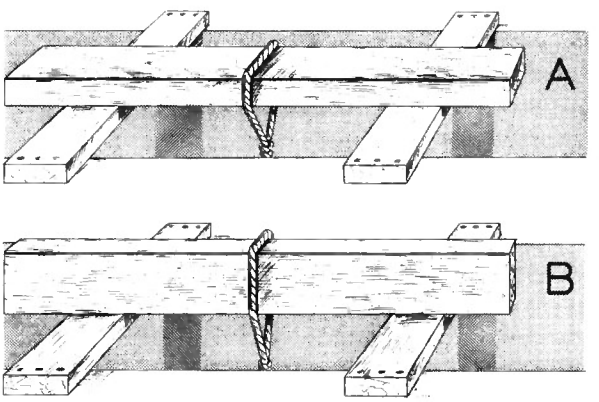
21

Which box weighs more?
(If equal, mark C.)



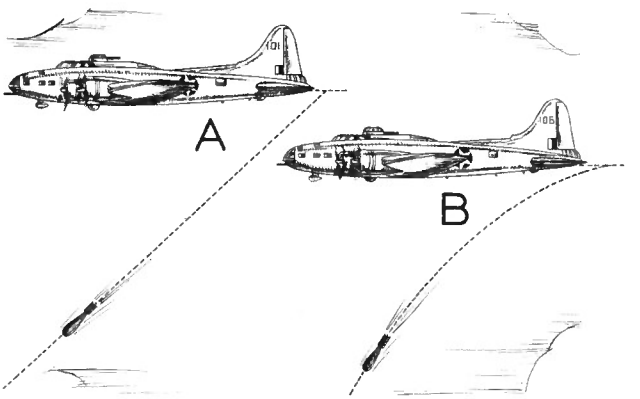
22

Which horse will jump more when it is pulled?
(If equal, mark C.)



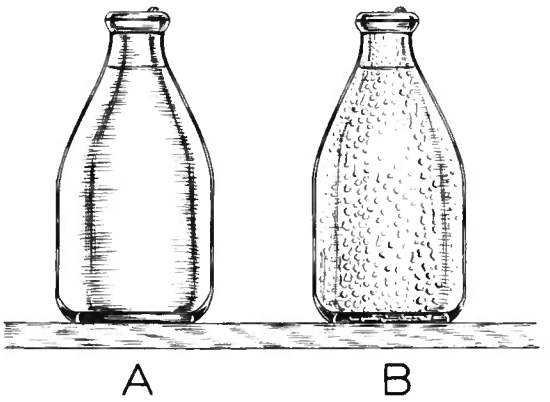
23

In which picture can you safely put a heavier weight on the rope?
(If equal, mark C.)



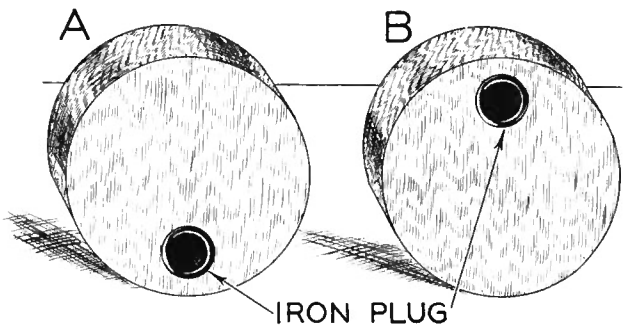
24

Which drawing shows how a bomb really falls?
(If both, mark C.)



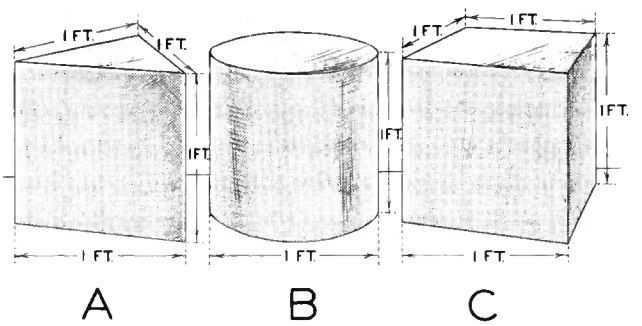
25

Which bottle has just been taken from the refrigerator?
(If neither, mark C.)



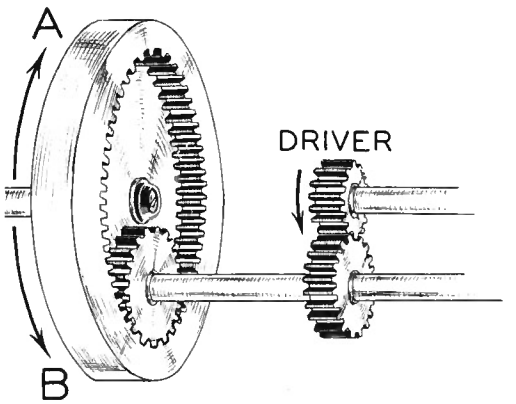
26

Which pieture shows how this wooden eirele will stand?
(If neither, mark C.)



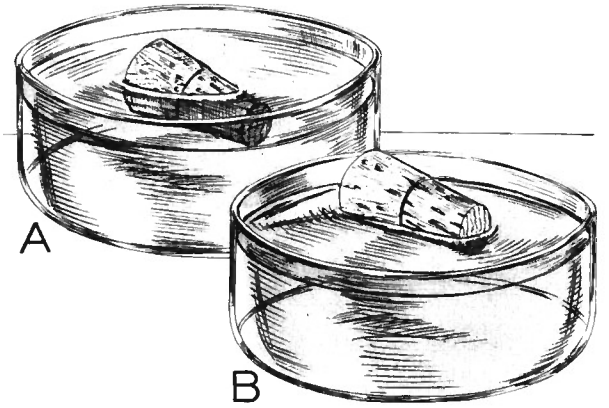
27

Which weighs least?



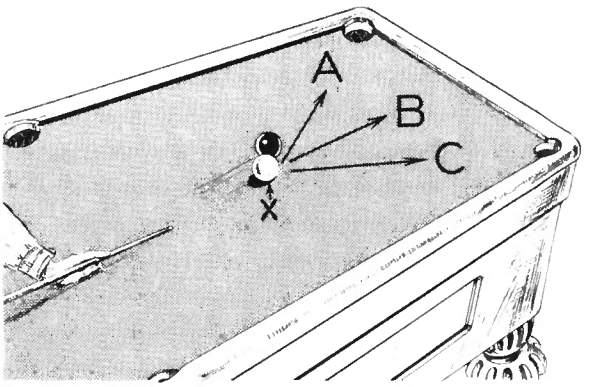
28

When the driver turns in the direetion shown, whieh way will the left-hand gear turn?
(If either, mark C.)



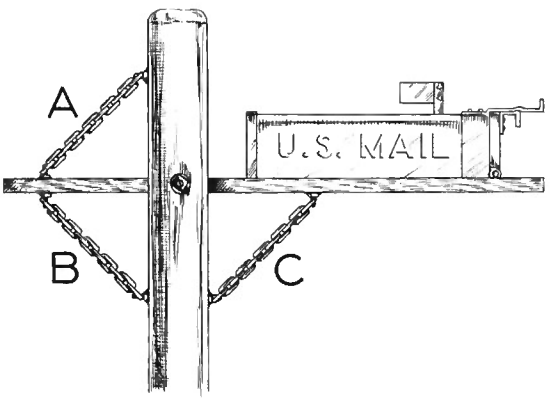
29

Which liquid is heavier?
(If equal, mark C.)



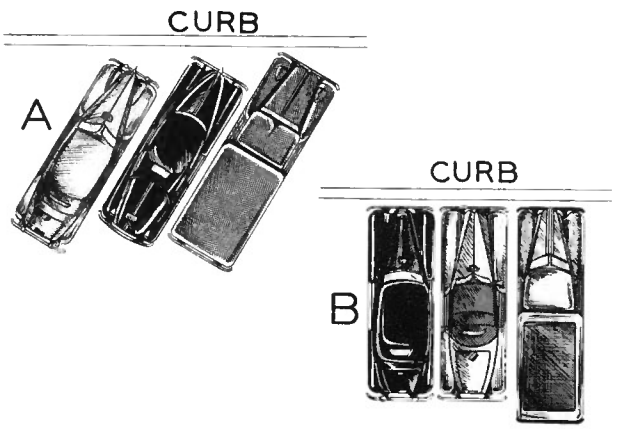
30

After hitting the black ball, which way will ball "X" go?



31

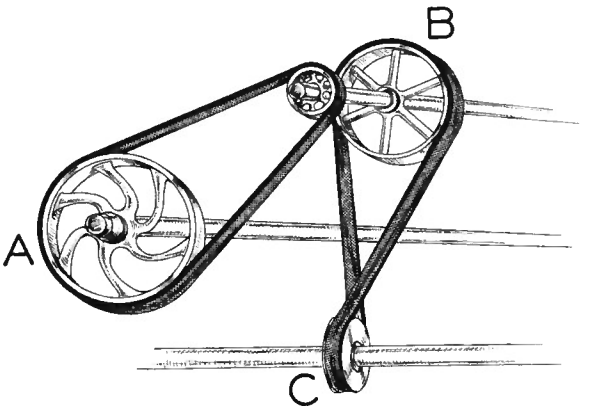
Which one piece of chain is needed to support the mail box?



32

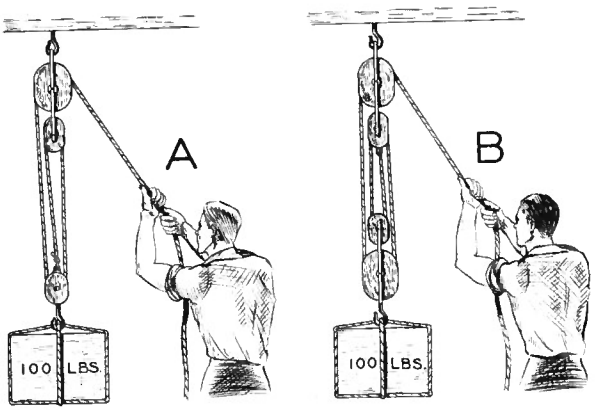
Which way can more cars be parked in a block?
(If equal, mark C.)

Do Not Stop. Go On to the Next Page.



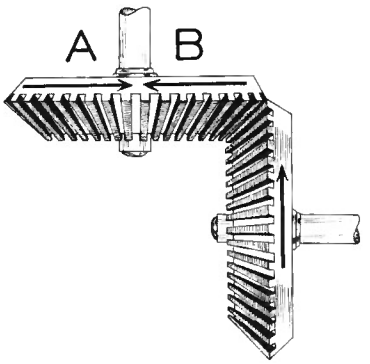
33

Which shaft will turn most rapidly?



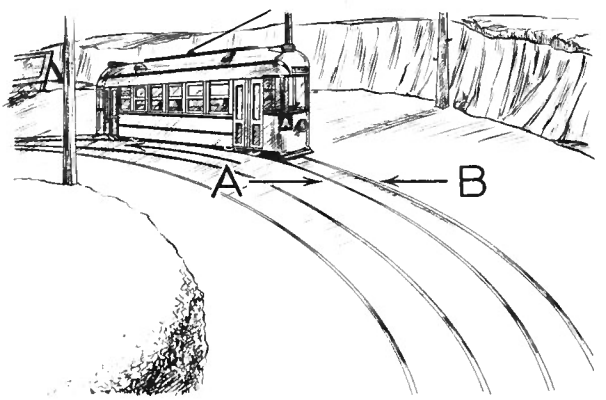
34

Which man can lift the load more easily?
(If equal, mark C.)



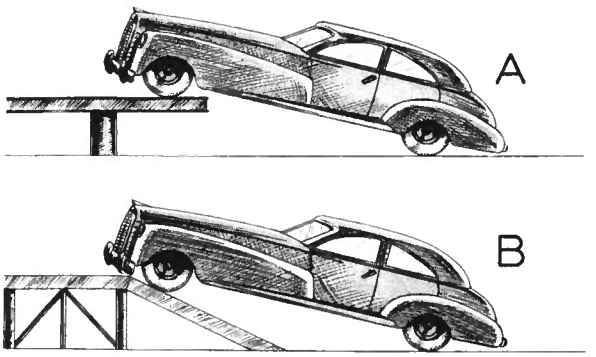
35

When the right-hand gear turns in the direction shown, which way does the top gear turn?
(If neither, mark C.)



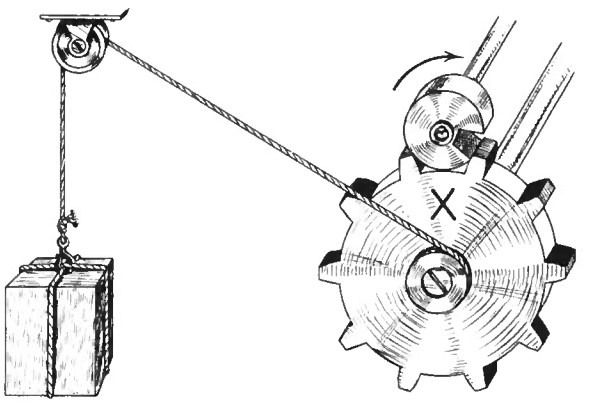
36

Which rail should be higher?
(If equal, mark C.)



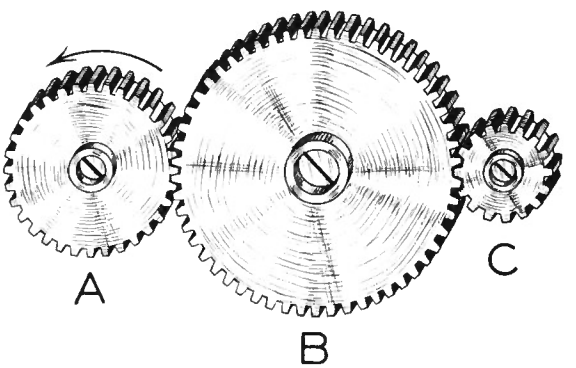
37

Which car is less likely to roll?
(If equal, mark C.)



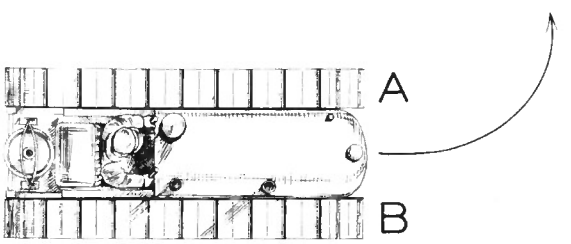
38

The top of wheel "X" will go:
(A) steadily to the right;
(B) steadily to the left;
(C) by jerks to the left.



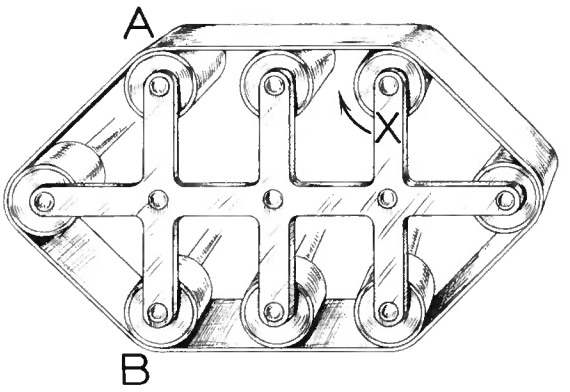
39

Which gear turns most times in a minute?



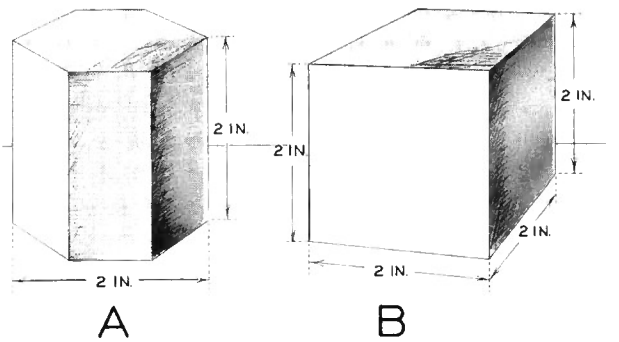
40

Which tread should be run more rapidly in order to turn the tractor in the direction shown?
(If neither, mark C.)



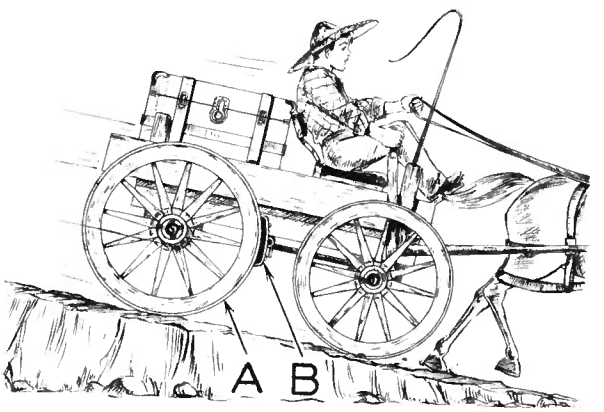
41

Which roller turns the same way as the roller at "X"?
(If both, mark C.)



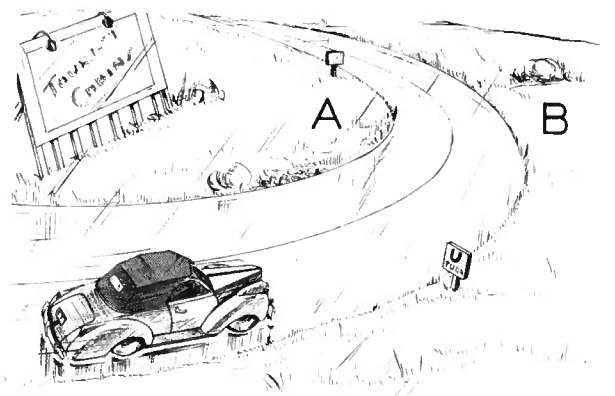
42

Which weighs more?
(If equal, mark C.)



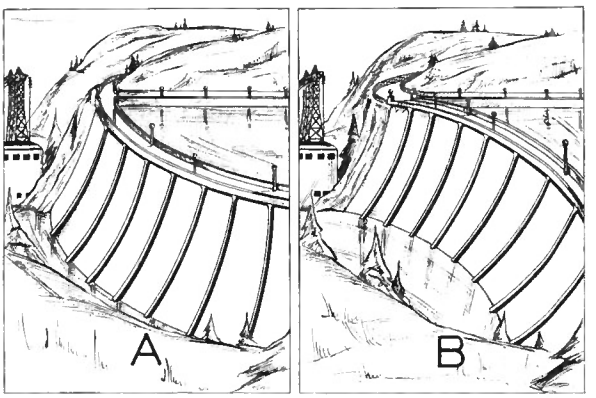
43

When the brake is put on, which part gets hotter?
(If equal, mark C.)



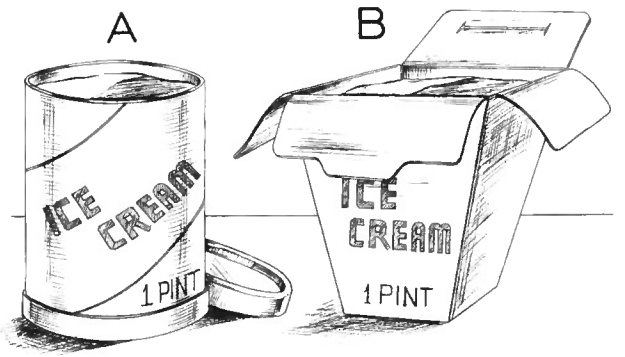
44

Off which side of the road is the car more likely to skid?
(If equal, mark C.)



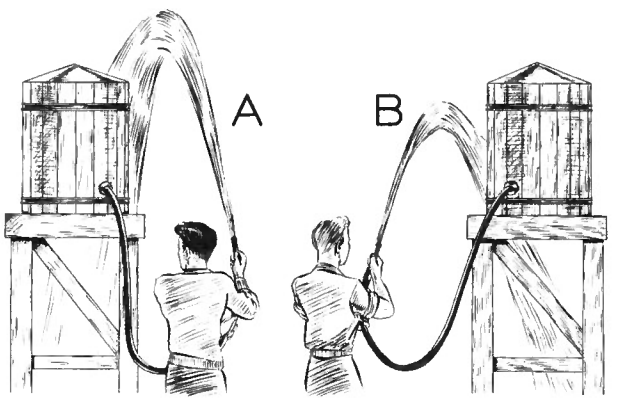
45

Which dam is stronger?
(If equal, mark C.)



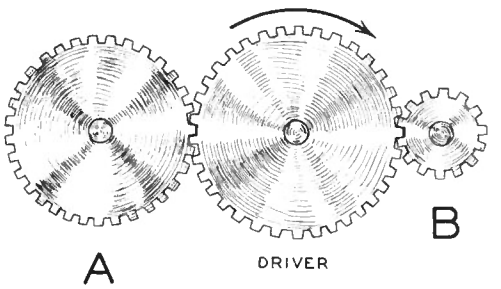
46

In which container will the ice cream stay hard longer?
(If equal, mark C.)



47

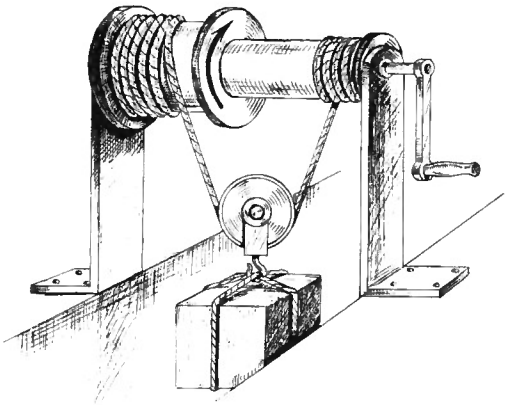
Which picture is correct?
(If both, mark C.)



48

Which gear turns the same way as the driver?
(If neither, mark C.)

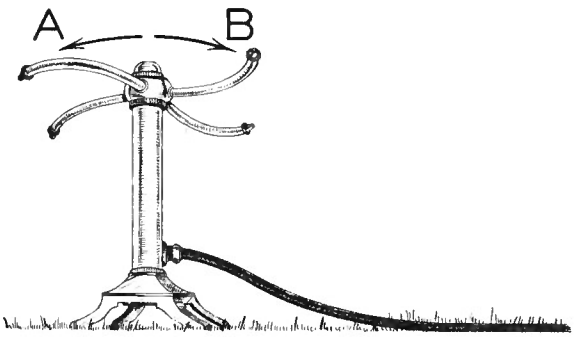
Do Not Stop. Go On to the Next Page.



49

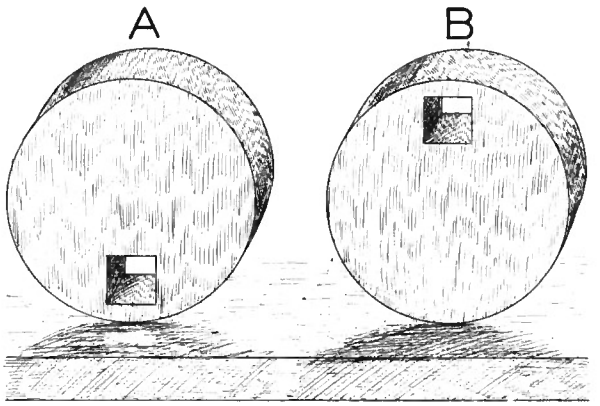
When the windlass is turned in the direction shown, the weight will:

(A) fall;
(B) stand still;
(C) rise.



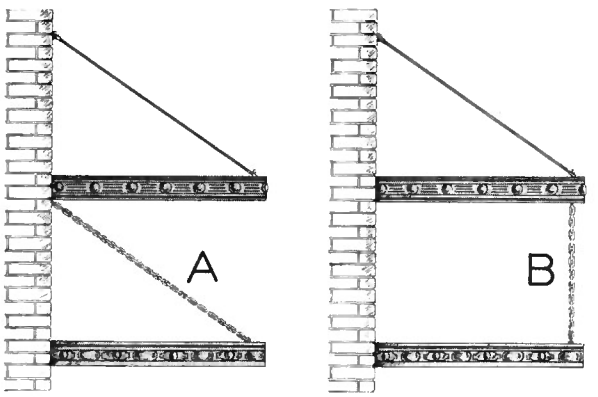
50

When the water is turned on, which way will the sprinkler turn? (If either, mark C.)



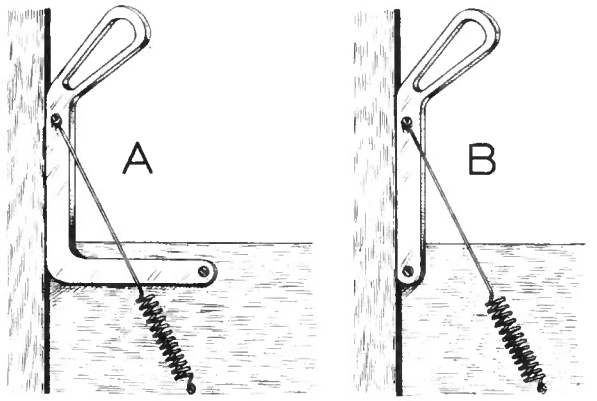
51

Which picture shows how this wooden circle will stand? (If neither, mark C.)



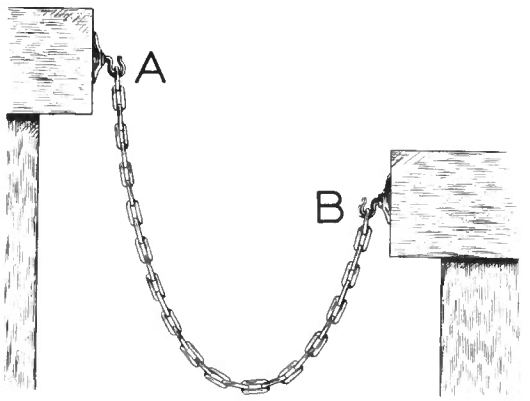
52

Which chain has more strain upon it? (If equal, mark C.)



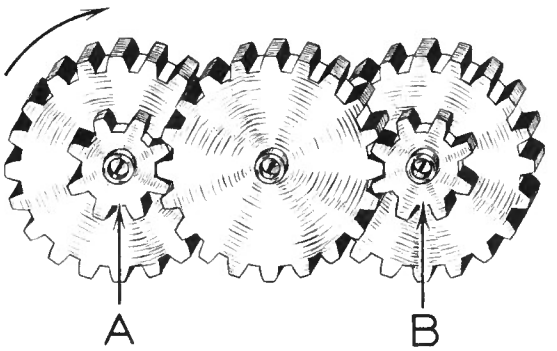
53

In which picture will the spring hold the handle where it now is?
(If both, mark C.)



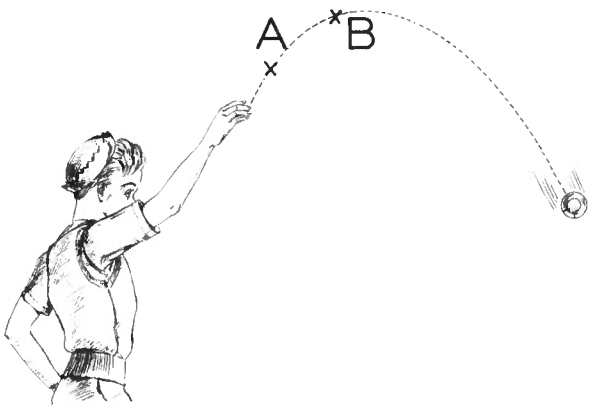
54

Which hook supports more weight?
(If equal, mark C.)



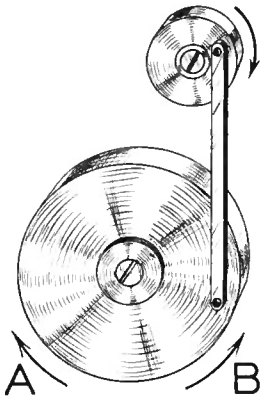
55

Which gear turns slower?
(If equal, mark C.)



56

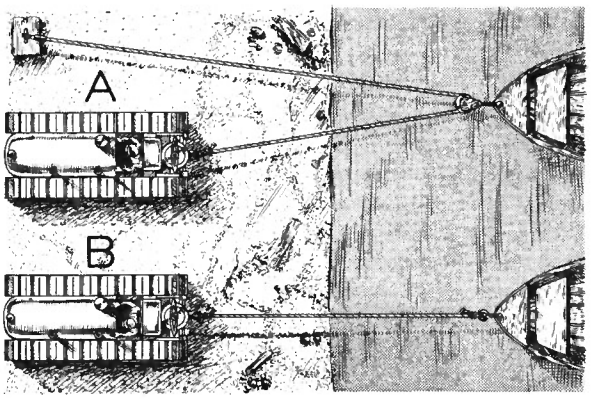
At which point was the ball going faster?
(If equal, mark C.)



57

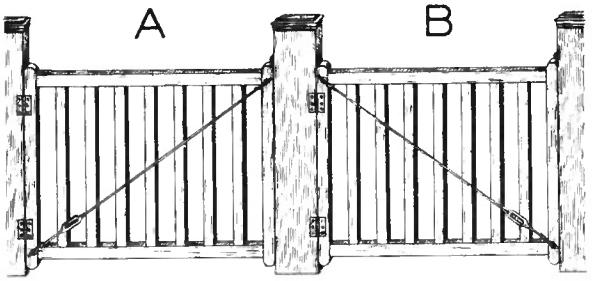
When the small wheel is turned around, the big wheel will:

(A) turn in direction A;
(B) turn in direction B;
(C) move back and forth.



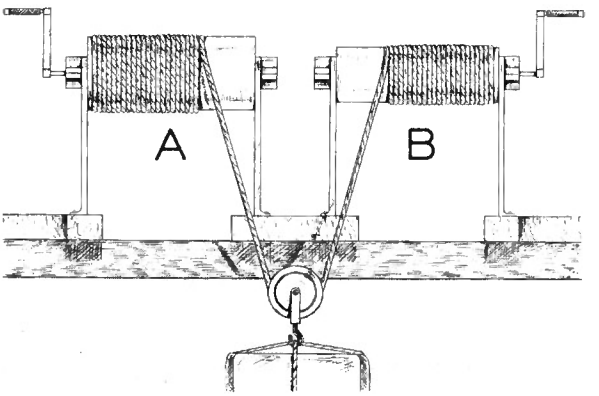
58

Which tractor must go further to pull the boat up on the beach? (If equal, mark C.)



59

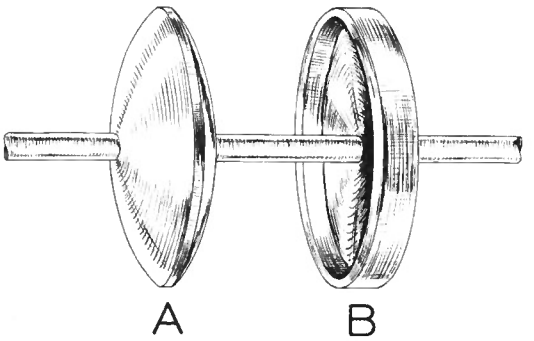
Which gate is better braced? (If equal, mark C.)



60

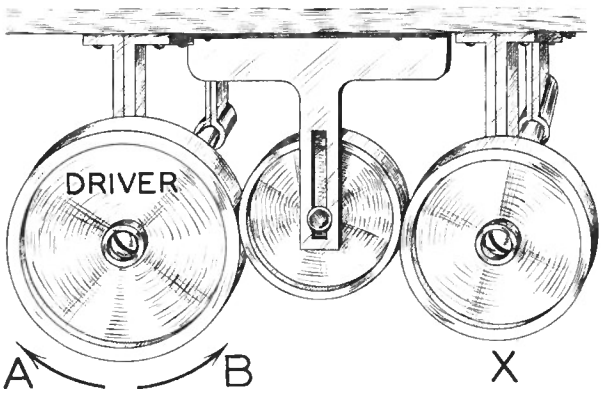
Which windlass will be harder to turn in order to lift the weight? (If equal, mark C.)

PUT YOUR ANSWERS ON THE ANSWER SHEET.



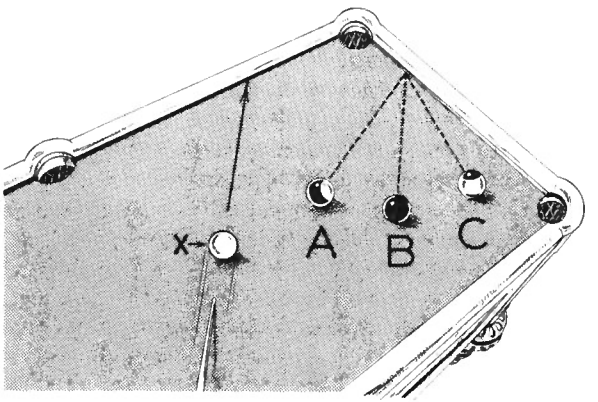
61

Which wheel is safer when spun at high speed?
(If equal, mark C.)



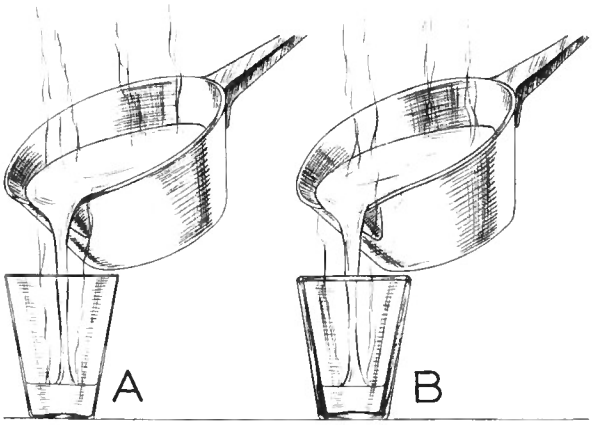
62

Which way must the driver turn to drive the wheel "X"?
(If either, mark C.)



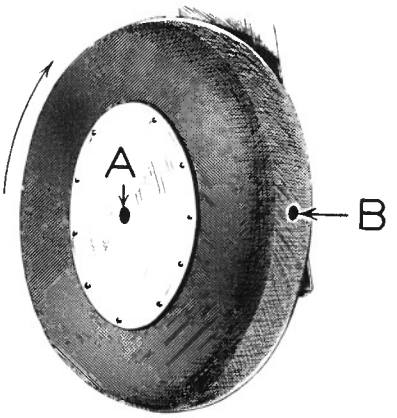
63

Which of these balls will the white ball "X" hit?



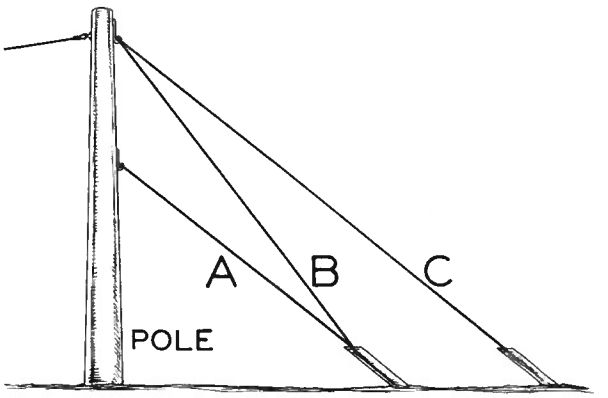
64

Which glass is more likely to break?
(If equal, mark C.)



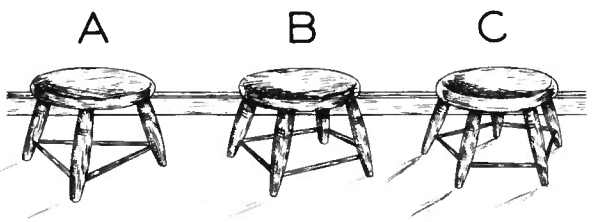
65

Which point moves faster when the wheel turns?
(If equal, mark C.)



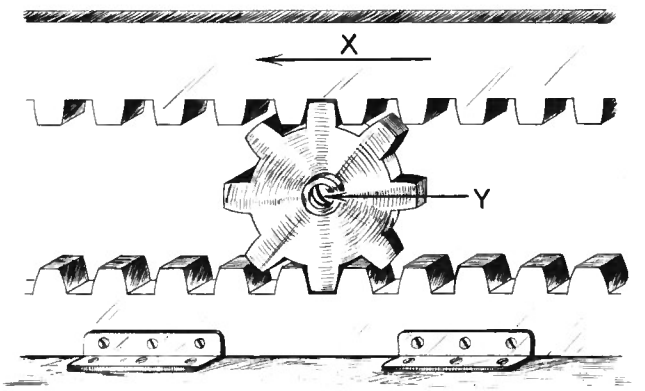
66

Which one piece of cable will give this pole the best support?



67

Which stool will be steadiest on uneven ground?



68

If "X" moves two feet in the direction shown, the center of the gear "Y" will move:

(A) more than two feet;
(B) less than two feet;
(C) two feet.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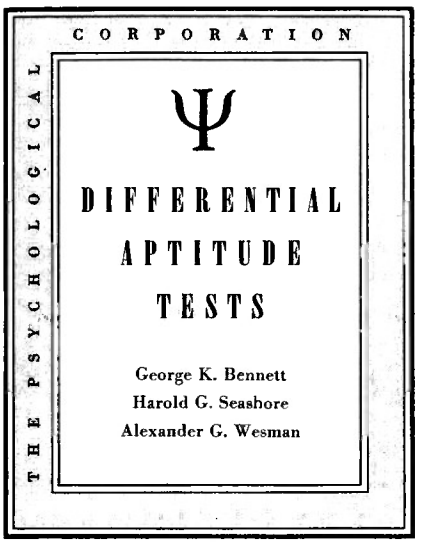
INCORPORATED
IN 1921



SPACE RELATIONS

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, print your name, address, and other requested information in the proper spaces.

In the space after **Form**, print an **A**.

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET

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Ψ Reg. U.S. Pat. Off.

55-186 TB

Do not make any marks in this booklet

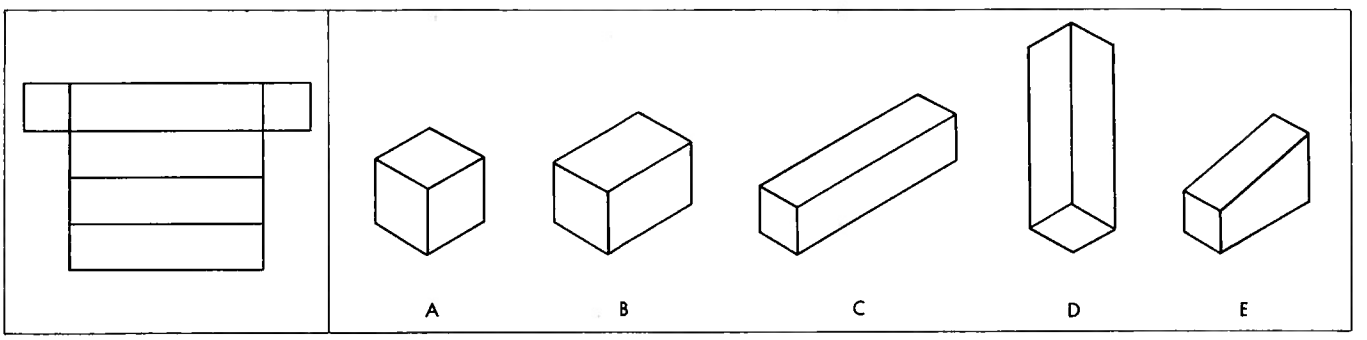
Mark your answers on the separate Answer Sheet

SPACE RELATIONS

DIRECTIONS

This test consists of forty patterns which can be folded into figures. For each pattern, five figures are shown. You are to decide which of these figures can be made from the pattern shown. The pattern always shows the outside of the figure. Here is an example:

EXAMPLE X



Which of these five figures — A, B, C, D, E — can be made from the pattern in Example X? A and B certainly cannot be made; they are not the right shape. C and D are correct both in shape and size. You cannot make E from this pattern.

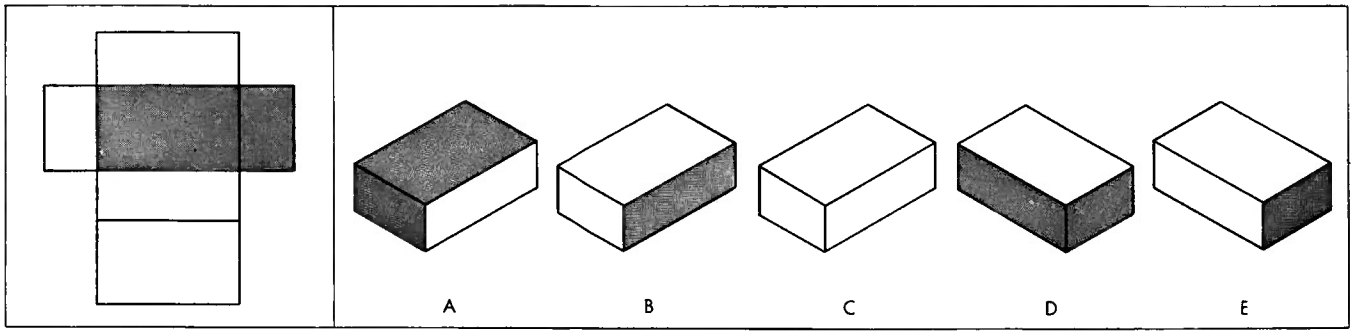
— In the test there will always be a row of five figures for each pattern.

— In every row there is at least one correct figure.

— Usually more than one is correct. In fact, in some cases, all five may be correct.

Now look at the pattern for Example Y and the five choices for it. Note that when the pattern is folded, the figure must have two gray surfaces. One of these is a large surface which could be either the top or bottom of a box. The other is a small surface which would be one end of the box.

EXAMPLE Y



Notice — all the "boxes" made from this pattern are correct in **shape,** but the sides which you see are different. Some of these figures can be made from this pattern while others cannot. Let us look at them.

— Figure A is correct. If the large gray surface is shown as the top, then the end surface of gray can be shown facing towards you.

— Figure B is wrong. The **long, narrow** side is not gray in the pattern.

— Figure C is correct. The two gray surfaces can both be hidden by placing the large gray surface at the bottom and the gray end to the back.

— Figure D is wrong. The gray end is all right, but there is no long gray side in the pattern.

— Figure E is correct. One can show the box so that the large gray surface is at the bottom (as it was in C), but with the gray end showing at the front.

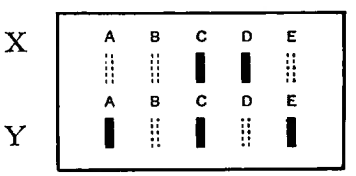
So, you see, there are three figures (A, C and E) which can be made from the pattern in Example Y, and two figures (B and D) which cannot be made from this pattern.

Remember that the surface you see in the pattern must always be the OUTSIDE surface of the completed figure.

Now let's see how we mark our answers on the separate Answer Sheet. A sample is shown here.

For Example X we found that only figures C and D could be made, so the spaces under C and D opposite X have been blackened. For Example Y, A is a correct figure, C is correct, and E is correct, so opposite Y we have blackened in the spaces under A, C and E.

SAMPLE OF ANSWER SHEET



In taking the test:

— Study each pattern.

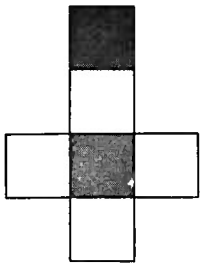
— Decide which of the figures can be made from the pattern.

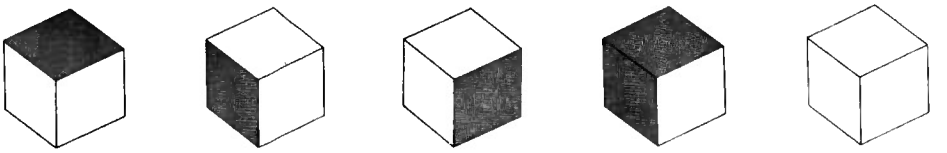
— Show your choices on the Answer Sheet by blackening in the little space under the letter which is the same as that of the figure you have chosen in the booklet.

— If you decide a certain figure cannot be made from the Pattern, make no mark on the Answer Sheet.

Do Not Write Anything in This Booklet
Use Separate Answer Sheet
You Will Be Told When to Begin

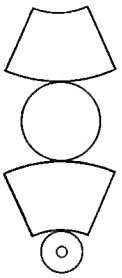
1

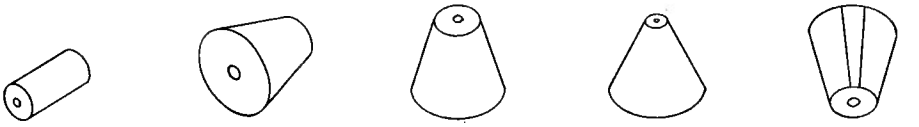




A B C D E

2





A B C D E

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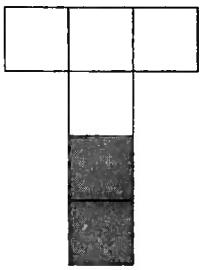
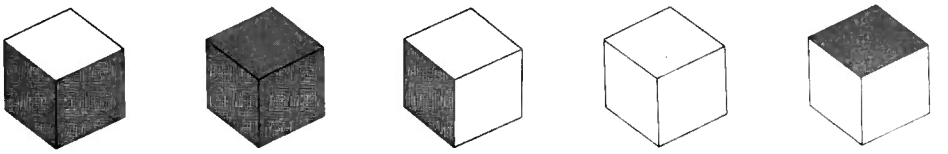
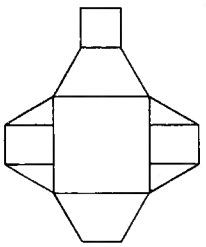
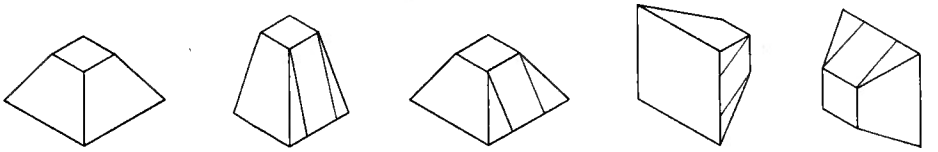




A B C D E

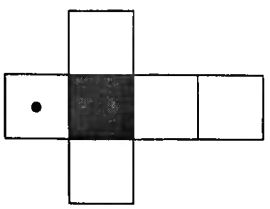
4

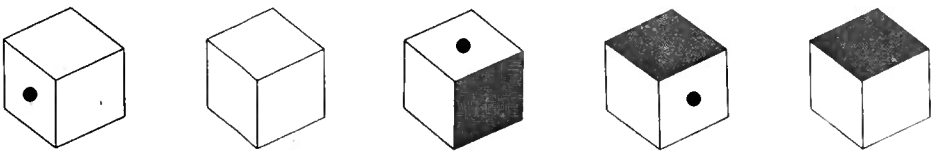




A B C D E

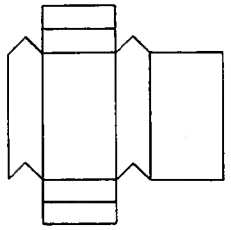
5

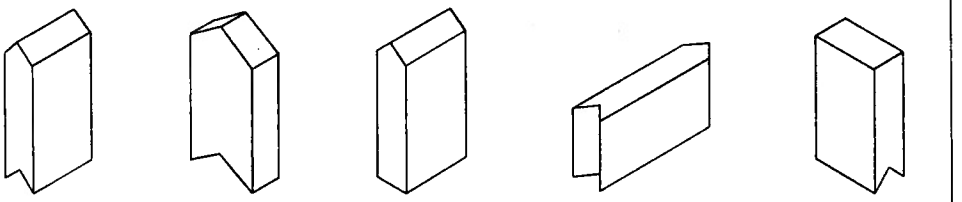




A B C D E

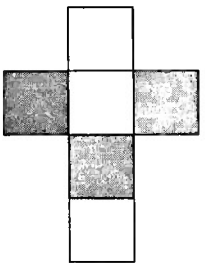
6

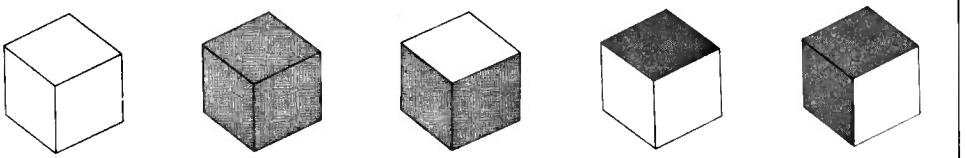




A B C D E

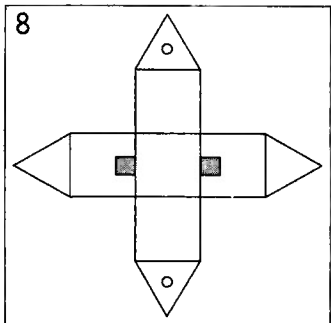
7

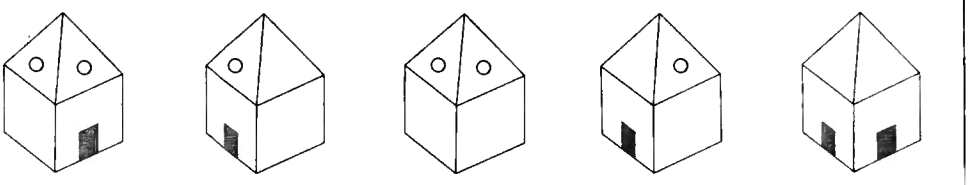




A B C D E

8





A B C D E

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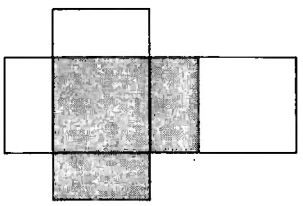

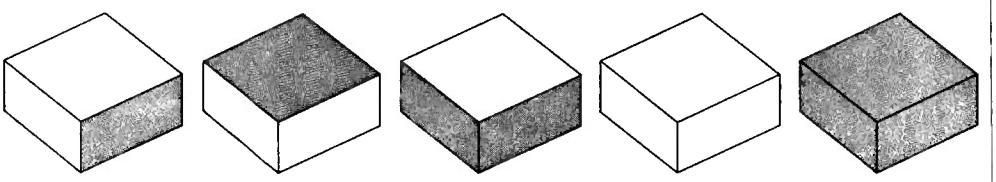

A B C D E

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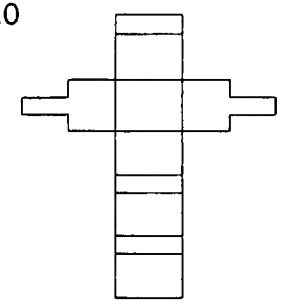

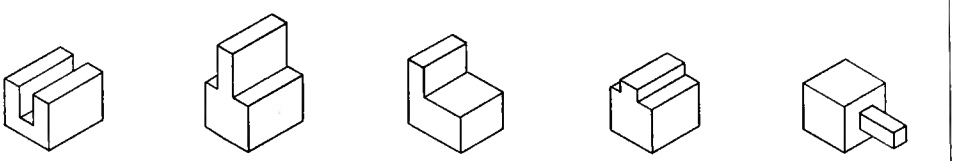

A B C D E

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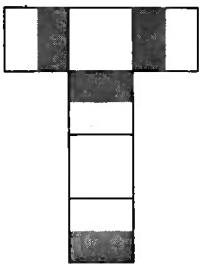

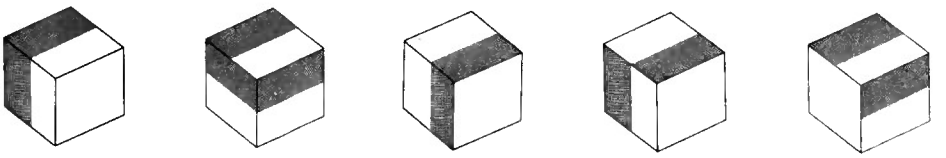

A B C D E

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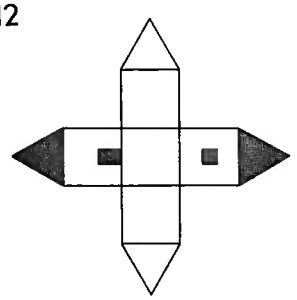

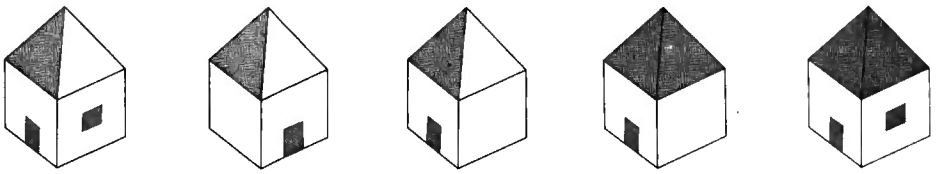

A B C D E

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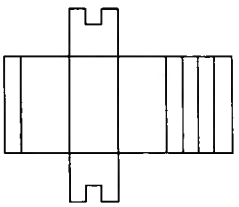

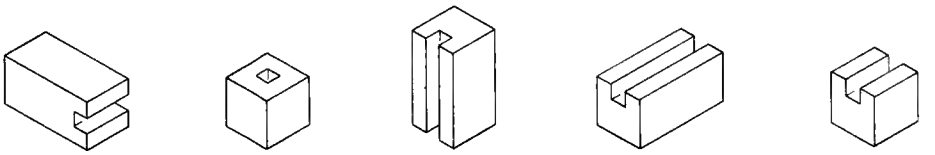

A B C D E

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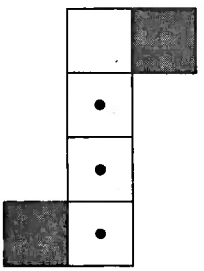

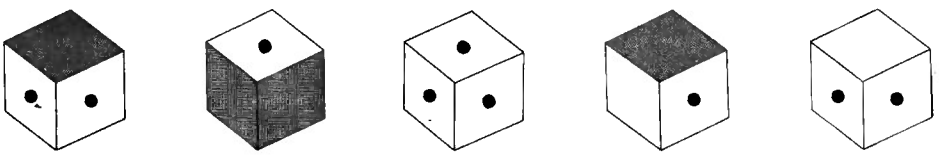

A B C D E

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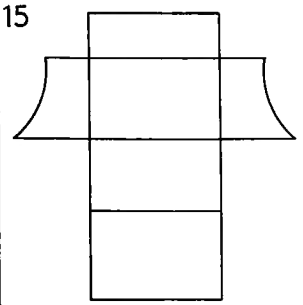

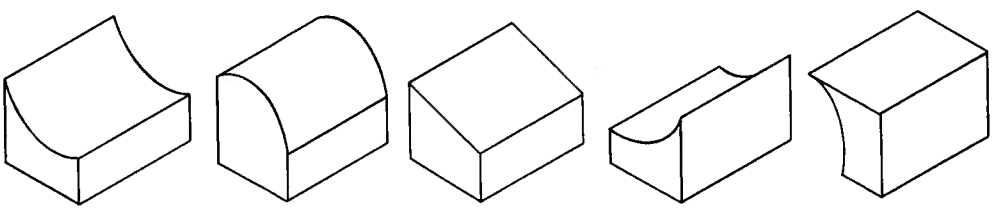

A B C D E

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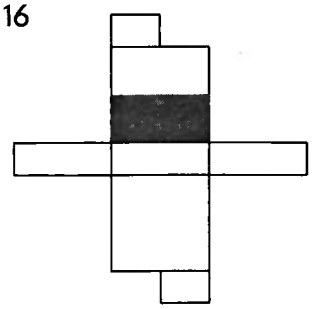

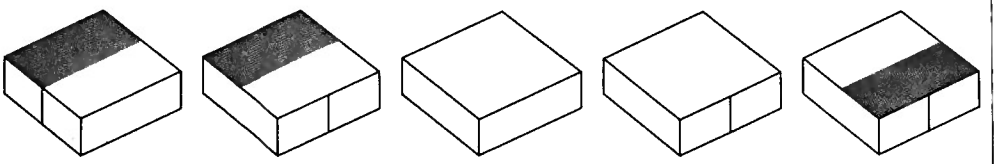

A B C D E

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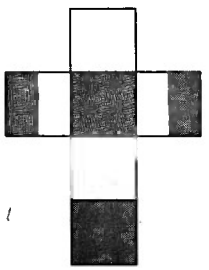

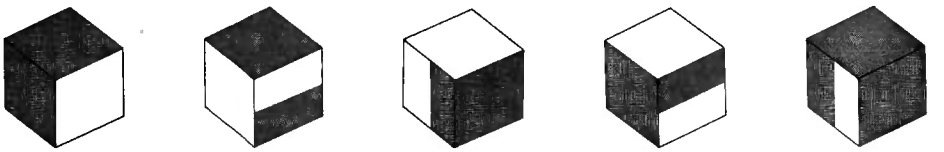

A B C D E

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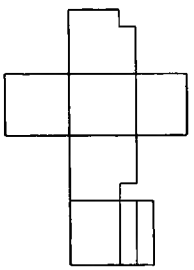
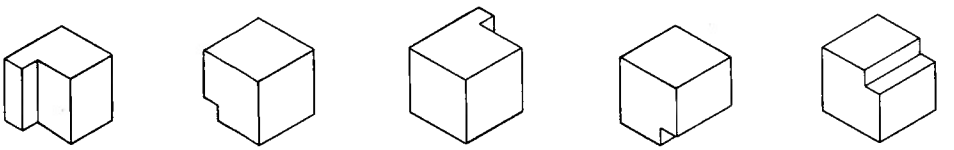
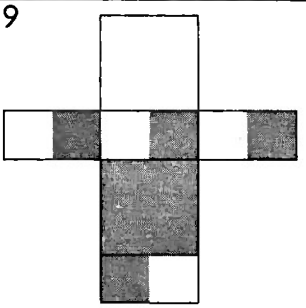
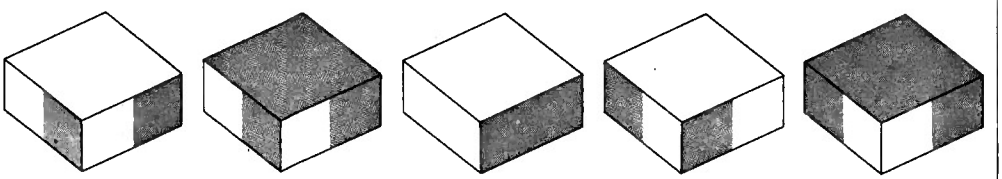




A B C D E

19





A B C D E

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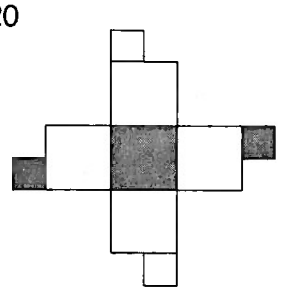

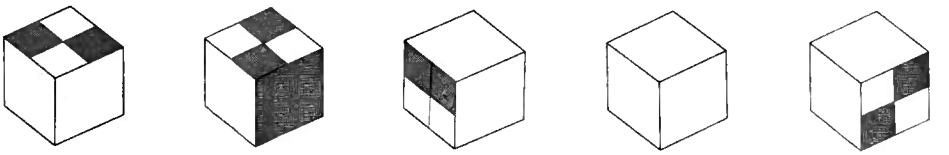

A B C D E

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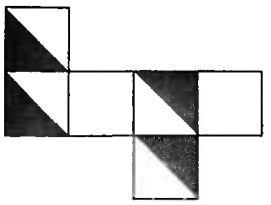

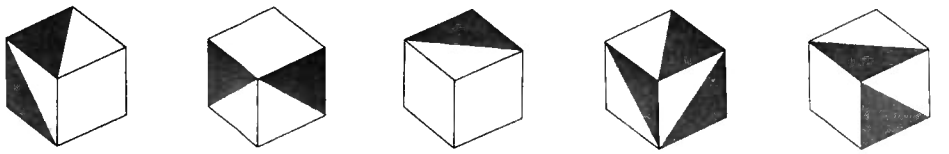

A B C D E

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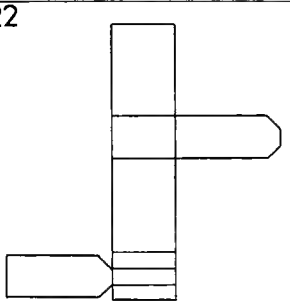

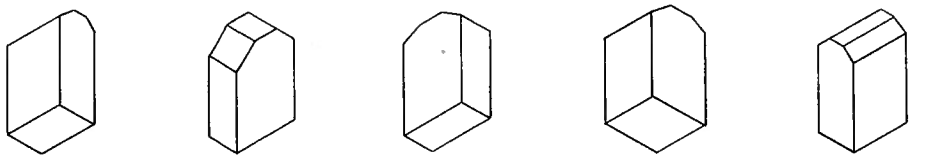

A B C D E

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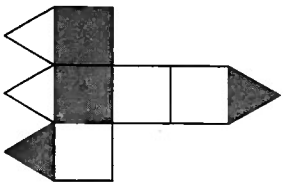
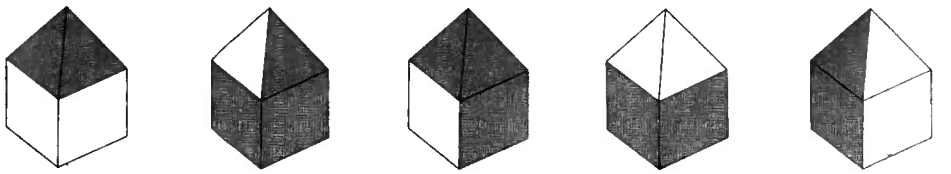
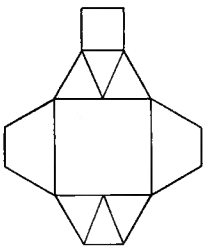
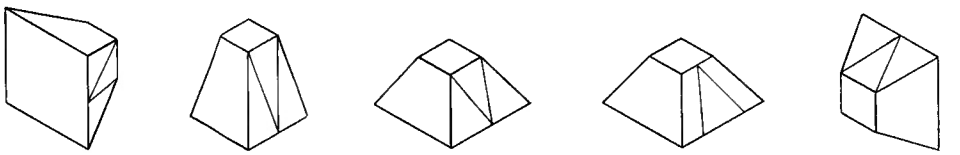




A B C D E

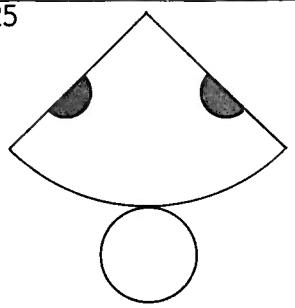
24

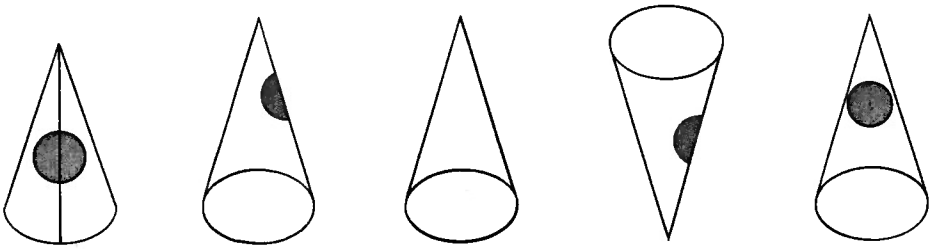




A B C D E

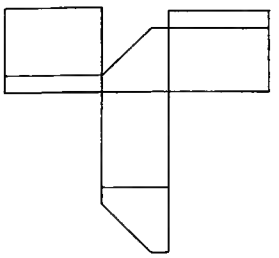
25

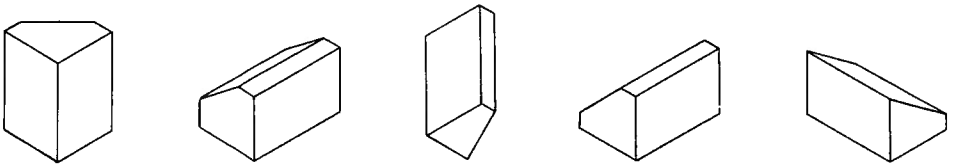




A B C D E

26





A B C D E

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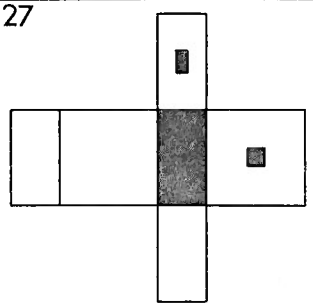

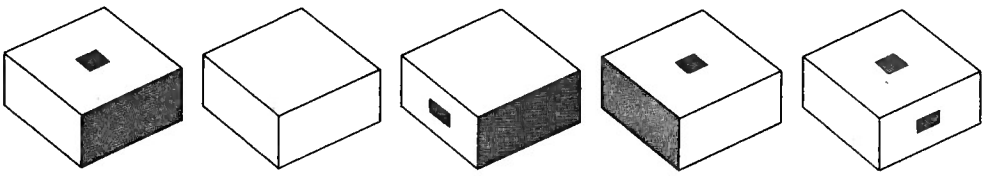

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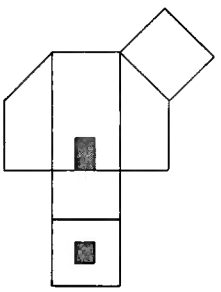

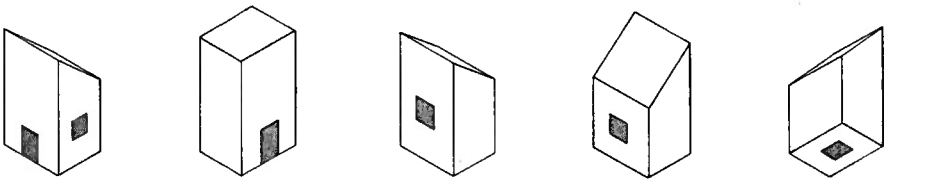

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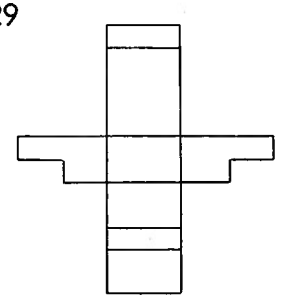

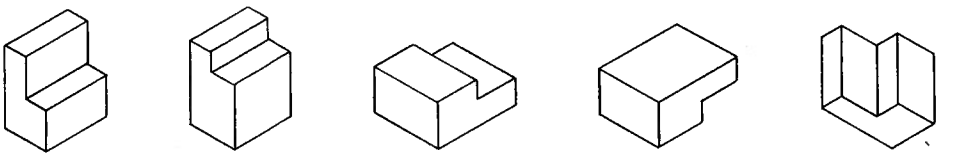

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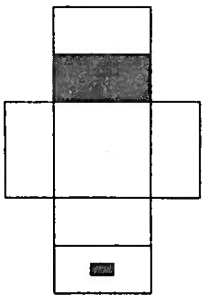

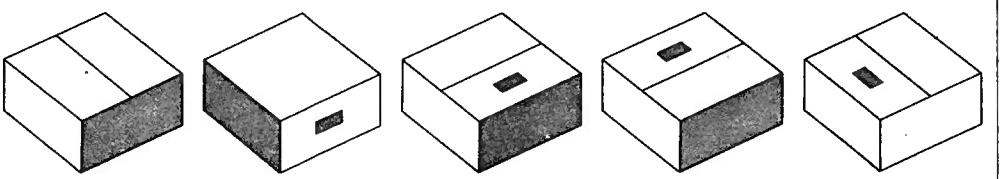

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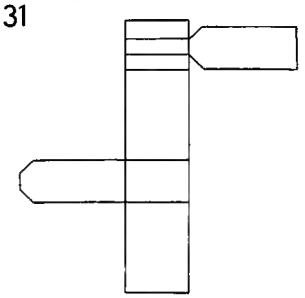

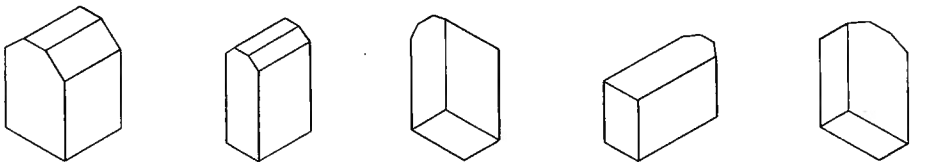

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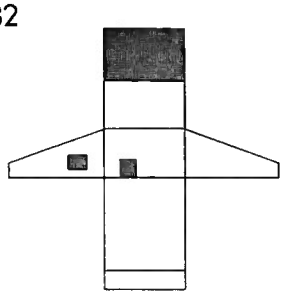

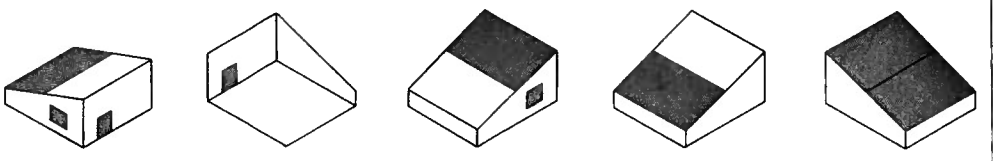

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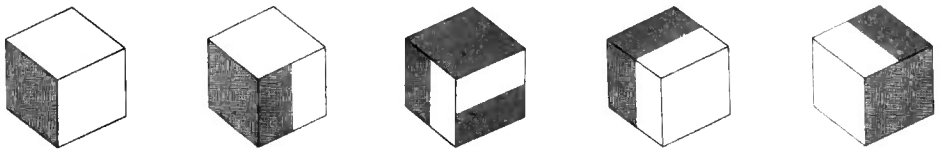

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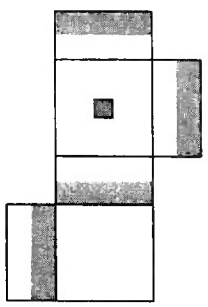

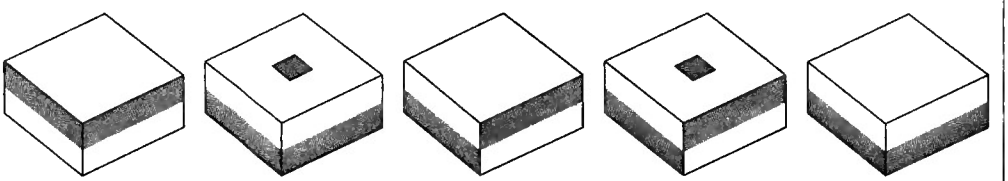

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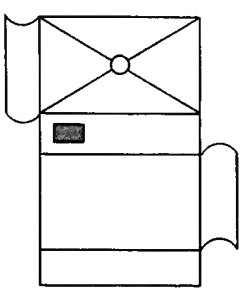

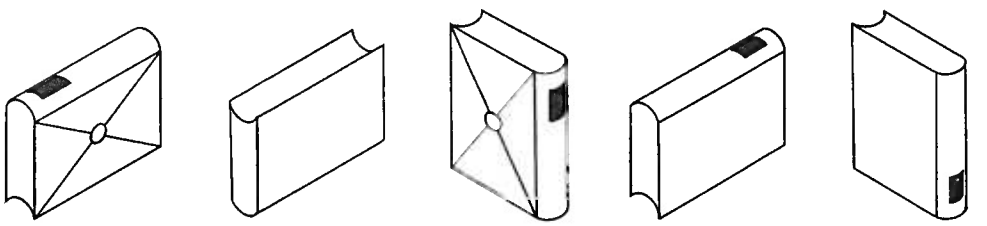

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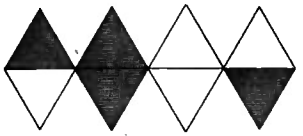

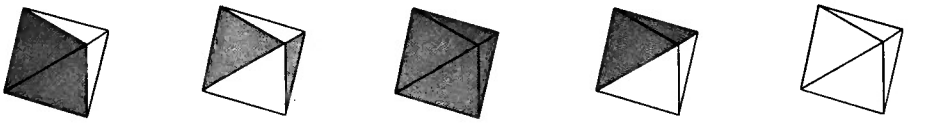

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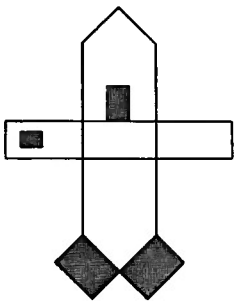

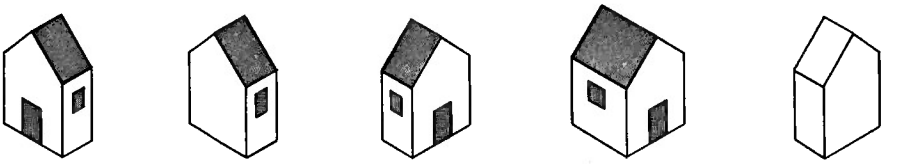

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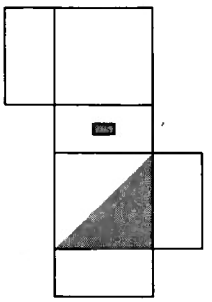

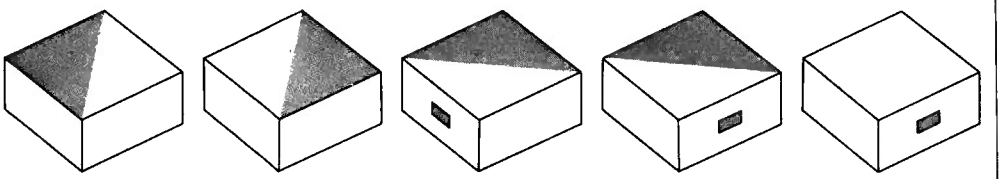

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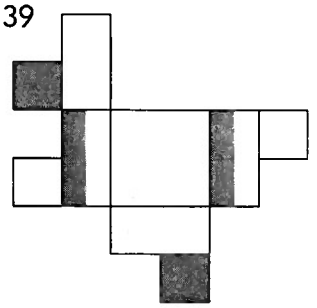

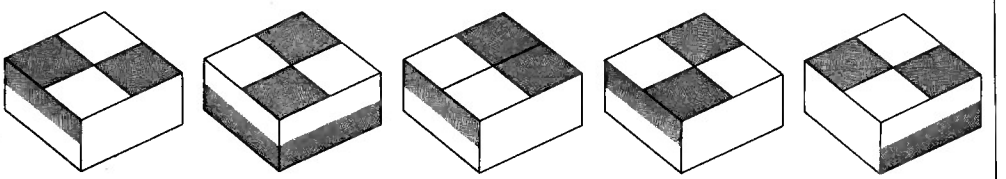

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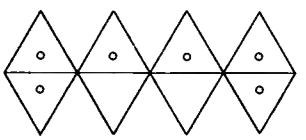

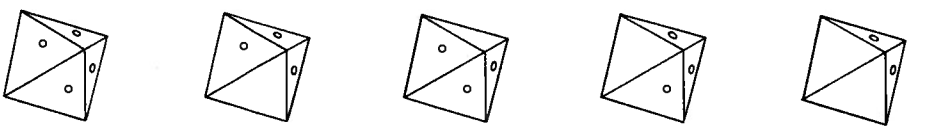

A B C D E

Otis Quick-Scoring Mental Ability Tests: New Edition

BETA TEST: FORM EM

BETA
EM

by Arthur S. Otis

Do not open this booklet, or turn it over, until you are told to do so.
Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name..... Grade..... Boy..... Girl.....
First name Initial Last name

Date of birth..... How old are you now?.....
Month Day Year

Date.....19.....School.....City and state.....

Read these directions. Do what they tell you to do.

This is a test to see how well you can think. It contains questions of different kinds. Under each question there are four or five possible answers. You are to read each question and decide which of the answers below it is the right answer. Do not spend too much time on any one question. Here are three sample questions.

Sample a: Which one of the five things below is soft?
(1) **glass** (2) **stone** (3) **cotton** (4) **iron** (5) **ice**

The right answer, of course, is *cotton*. The word *cotton* is No. 3. Now look at the "Answer Spaces for Samples" at the right. In the five spaces after the Sample "a," a heavy mark has been made, filling the space under the 3. This is the way to answer the questions.

Try the next sample question yourself. Do not write the answer; just put a heavy mark in the space under the number corresponding to the right answer.

ANSWER SPACES FOR SAMPLES

	1	2	3	4	5
a			■		
	6	7	8	9	10
b					
	11	12	13	14	15
c					

Sample b: A robin is a kind of —
(6) **plant** (7) **bird** (8) **worm** (9) **fish** (10) **flower**

The answer is *bird*, which is answer 7; so you should answer Sample "b" by putting a heavy mark in the space under the 7. Try the Sample "c."

Sample c: Which one of the five numbers below is larger than 55?
(11) **53** (12) **48** (13) **29** (14) **57** (15) **16**

The correct answer for Sample "c" is 57, which is No. 14; so you would answer Sample "c" by making a heavy black mark that fills the space under the number 14. Do this now.

Read each question carefully and decide which one of the answers is best. Notice what number your choice is. Then, on the answer sheet, make a heavy black mark in the space under that number. In marking your answers, always be sure that the question number on the answer sheet is the same as the question number in the test booklet. Erase completely any answer you wish to change, and be careful not to make stray marks of any kind on your answer sheet or on your test booklet. When you finish a page, go on to the next page. If you finish the entire test before the time is up, go back and check your answers. Work as rapidly and as accurately as you can.

The test contains 80 questions. You are not supposed to be able to answer all of them, but do the best you can. You will be allowed half an hour after the examiner tells you to start. Try to get as many questions right as possible. Be careful not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions about the test will be answered by the examiner after the test begins. Lay your pencil down.

Do not turn this booklet until you are told to begin.

Published by World Book Company, Yonkers-on-Hudson, New York, and Chicago, Illinois

ANSWER SHEET

IQ_____

SCORE_____

AGE_____ Years _____ Months

Page 6

64 61 62 63 64 65

65 66 67 68 69 70

66 71 72 73 74 75

67 1 2 3 4 5

68 6 7 8 9 10

69 11 12 13 14 15

70 16 17 18 19 20

71 21 22 23 24 25

72 26 27 28 29

73 31 32 33 34 35

74 36 37 38 39 40

75 41 42 43 44 45

76 46 47 48 49 50

77 51 52 53 54 55

78 56 57 58 59

79 61 62 63 64 65

80 66 67 68 69 70

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45 41 42 43 44 45

46 46 47 48 49

47 51 52 53 54 55

48 56 57 58 59

49 61 62 63 64 65

50 66 67 68 69

51 71 72 73 74 75

52 1 2 3 4 5

53 6 7 8 9 10

54 11 12 13 14 15

55 16 17 18 19 20

56 21 22 23 24 25

57 26 27 28 29 30

58 31 32 33 34 35

59 36 37 38 39

60 41 42 43 44 45

61 46 47 48 49 50

62 51 52 53 54

63 56 57 58 59

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25 26 27 28 29 30

26 31 32 33 34 35

27 36 37 38 39 40

28 41 42 43 44 45

29 46 47 48 49 50

30 51 52 53 54

31 56 57 58 59 60

32 61 62 63 64 65

33 66 67 68 69

34 71 72 73 74 75

35 76 77 78 79 80

36 81 82 83 84 85

37 1 2 3 4 5

38 6 7 8 9 10

39 11 12 13 14 15

40 16 17 18 19

41 21 22 23 24 25

42 26 27 28 29 30

43 31 32 33 34 35

44 36 37 38 39 40

Page 3

1 1 2 3 4 5

2 6 7 8 9 10

3 11 12 13 14 15

4 16 17 18 19 20

5 21 22 23 24

6 26 27 28 29 30

7 31 32 33 34 35

8 36 37 38 39

9 41 42 43 44 45

10 46 47 48 49 50

11 51 52 53 54 55

12 56 57 58 59 60

13 61 62 63 64 65

14 66 67 68 69 70

15 71 72 73 74 75

16 76 77 78 79

17 81 82 83 84 85

18 86 87 88 89 90

19 91 92 93 94 95

20 1 2 3 4 5

21 6 7 8 9 10

22 11 12 13 14 15

23 16 17 18 19 20

24 21 22 23 24 25

NOTE. *This Answer Sheet is not intended for machine scoring.*

1 The opposite of weak is —
(1) **poor** (2) **sick** (3) **tall** (4) **strong** (5) **young**

2 Which of the five words below comes first in the dictionary?
(6) **brown** (7) **black** (8) **blown** (9) **break** (10) **blend**

3 Which answer tells best what a teakettle is?
(11) **a tool** (12) **a weapon** (13) **a utensil** (14) **a thing** (15) **a machine**

4 An eggshell is to an egg the same as an orange skin is to —
(16) **a lemon skin** (17) **an orange** (18) **an orange seed** (19) **a hen** (20) **a clamshell**

5 Ruth is prettier than Sadie but not so pretty as Mabel. Therefore, Mabel is (?) Sadie.
(21) **not so pretty as** (22) **just as pretty as** (23) ***cannot say which*** (24) **prettier than**

6 The mayor is to a city as the governor is to —
(26) **a nation** (27) **a president** (28) **a state** (29) **a council** (30) **an office**

7 A stove is to heat as a refrigerator is to —
(31) **a kitchen** (32) **cold** (33) **electricity** (34) **gas** (35) **food**

8 Three of the four designs at the right are alike in some way. Which one is not like the other three?
(36)  (37)  (38)  (39) 

9 Northwest is to southeast as up is to —
(41) **north** (42) **higher** (43) **northeast** (44) **down** (45) **under**

10 The opposite of clockwise is —
(46) **backward** (47) **counterclockwise** (48) **right** (49) **left** (50) **round**

11 Which of the five words below comes first in the dictionary?
(51) **times** (52) **stand** (53) **ruled** (54) **grand** (55) **quill**

12 Which of the five persons below is most like a carpenter, a plumber, and a bricklayer?
(56) **a postman** (57) **a lawyer** (58) **a truck driver** (59) **a doctor** (60) **a painter**

13 Which of the following sentences tells best what an arm is?
(61) **It goes in the coat sleeve.** (62) **You can put it around something.**
(63) **It carries the hand.** (64) **It is the part of the body attached to the shoulder.**
(65) **We have two of them.**

14 Four of the following things are alike. Which one is different from the other four?
(66) **a beet** (67) **a peach** (68) **a radish** (69) **an onion** (70) **a potato**

15 What is to hearing as an eye is to sight?
(71) **glasses** (72) **voices** (73) **a sound** (74) **an ear** (75) **an earphone**

16 Three of the four designs at the right are alike in some way. Which one is not like the other three?
(76)  (77)  (78)  (79) 

17 Which of the five things below is most like the moon, a balloon, and a ball?
(81) **sky** (82) **a cloud** (83) **a marble** (84) **an airplane** (85) **a toy**

18 Fur is to a rabbit as feathers are to —
(86) **a pillow** (87) **a bird** (88) **a hair** (89) **an animal** (90) **a nest**

19 What is the most important reason for using screens at windows?
(91) **They are easy to paint.** (92) **They improve the looks of the windows.**
(93) **They keep out flies but let in the breeze.** (94) **They keep out burglars.**
(95) **They are easier to keep clean than windows are.**

20 Which of the five words below comes *last* in the dictionary?
(1) **front** (2) **local** (3) **lemon** (4) **floor** (5) **knoll**

21 The moon (?) around the earth. (Which of the following words completes the sentence best?)
(6) **turns** (7) **goes** (8) **moves** (9) **revolves** (10) **spins**

22 Printing is to a book as writing is to —
(11) **talking** (12) **a letter** (13) **a pen** (14) **a friend** (15) **reading**

23 Which of the five things below is most like a chimney, a roof, and a door?
(16) **a chair** (17) **a bed** (18) **a stove** (19) **a window** (20) **a desk**

24 The ground is to an automobile as water is to —
(21) **a train** (22) **gasoline** (23) **the engine** (24) **a ship** (25) **a river**

(*Go on to the next page.*)

64 The one of two objects that is not so good as the other is said to be —
(61) **unsuitable** (62) **lesser** (63) **single** (64) **inferior** (65) **unnecessary**....

65 If the following words were rearranged to make the best sentence, the *last* word of the sentence would begin wi what letter?
fall clouds from the raindrops dark
(66) **f** (67) **d** (68) **t** (69) **c** (70) **r**.....

66 An object or institution that is not likely to move or change is said to be —
(71) **fundamental** (72) **stable** (73) **temporary** (74) **solid** (75) **basic**.....

67 Worst is to bad as (?) is to good.
(1) **more** (2) **better** (3) **best** (4) **very good** (5) **excellent**.....

68 If the following persons were arranged in order, which one would be in the middle?
(6) **grandfather** (7) **grandson** (8) **brother** (9) **uncle** (10) **nephew**.....

69 A man who buys and sells when there is considerable danger of loss is said to —
(11) **transact** (12) **stipulate** (13) **contract** (14) **speculate** (15) **bargain**.....

70 Which tells best what a refrigerator is?
(16) **a piece of kitchen furniture** (17) **a place to store food**
(18) **an electrical device for the kitchen** (19) **a large white box**
(20) **a cabinet for keeping food cold**.....

71 There is a saying, "A bird in the hand is worth two in the bush." It means — (21) **Two birds are worth more than on**
(22) **Something you are sure of is twice as good as something doubtful.**
(23) **Your own bird is worth two that belong to others.**
(24) **It is hard to catch birds that are in bushes.**.....

72 When the time by a clock was 14 minutes past 9, the hands were interchanged. The clock then said about —
(26) **14 minutes past 3** (27) **14 minutes of 10** (28) **14 minutes past 2**
(29) **14 minutes of 3**.....

73 One number is wrong in the following series. What should that number be?
1 9 2 8 3 9 4 8 5 9 6 8 7 9 8 9
(31) **9** (32) **7** (33) **8** (34) **6** (35) **5**.....

74 The boy deserves (?) for his effort and perseverance.
(36) **condemnation** (37) **censure** (38) **scholarship** (39) **commendation**
(40) **a medal**.....

75 One number is wrong in the following series. What should that number be?
1 2 4 8 16 32 48 128
(41) **96** (42) **6** (43) **64** (44) **12** (45) **24**.....

76 If I have a large box with 4 smaller boxes in it and 3 very small boxes in each small box, how many boxes do I have in all?
(46) **7** (47) **12** (48) **13** (49) **16** (50) **17**.....

77 If each 3 in the following series were changed to a 2 and if each 1 were dropped out, the seventh 2 would be followe by what number? (Do not mark the paper.)
1 2 5 2 3 1 5 2 3 4 2 3 1 3 4 2 2 2 5
(51) **1** (52) **3** (53) **2** (54) **4** (55) **5**.....

78 There is a saying, "An ounce of prevention is worth a pound of cure." It means —
(56) **Prevention is a good cure.** (57) **Prevention and cure can be purchased by weigh**
(58) **It is much better to prevent something than to cure it.**
(59) **It is much better to cure something than to prevent it.**.....

79 Which of the five words below is most like heavy, blue, and nice?
(61) **weight** (62) **round** (63) **sky** (64) **color** (65) **weather**.....

80 In a foreign language, *boli deta kipo* means *very good weather; boli cora* means *bad weather;* and *deta sedu* means *very h* What word means *good?*
(66) **boli** (67) **deta** (68) **cora** (69) **kipo** (70) **sedu**.....

25 If grapefruit are 4 for a quarter, how much will two dozen cost?
(26) **23¢** (27) **60¢** (28) **96¢** (29) **$1.50** (30) **$1.00**

26 The author is to a book as the inventor is to a —
(31) **machine** (32) **bookmark** (33) **discoverer** (34) **writer** (35) **magazine**

27 Which of the following tells best what a kitchen is?
(36) **a room in which to cook** (37) **a place to keep knives and forks**
(38) **a part of a house** (39) **a room with a table and chairs**
(40) **a room next to the dining room**

28 If the following words were rearranged to make the best sentence, with what letter would the *last* word of the sentence begin?
wood made often of are floors
(41) **a** (42) **m** (43) **w** (44) **f** (45) **o**

29 Which of the five things below is most like tea, milk, and lemonade?
(46) **water** (47) **vinegar** (48) **coffee** (49) **olive oil** (50) **mustard**

30 Three of the four designs at the right are alike in some way. Which one is not like the other three?
(51)  (52)  (53)  (54) 

31 Which of the sentences below tells best what a kitten is?
(56) **It has whiskers.** (57) **It is a small animal that drinks milk.**
(58) **It is a playful animal.** (59) **It is afraid of dogs.** (60) **It is a young cat.**

32 If the following were arranged in order, which one would be in the middle?
(61) **pint** (62) **barrel** (63) **cup** (64) **quart** (65) **gallon**

33 If Tom is brighter than Dick and Dick is just as bright as Harry, then Harry is (?) Tom.
(66) **brighter than** (67) **not so bright as** (68) **just as bright as** (69) ***cannot say which***

34 Count each 4 that has a 2 next after it in this row.
2 4 1 4 2 3 5 4 6 2 4 7 5 2 4 4 2 3 9 4 3 2 8 7 8 4 2 2 4 5 5 2 2 4 2
How many are there?
(71) **1** (72) **2** (73) **3** (74) **4** (75) **5**

35 The opposite of ignorance is —
(76) **beauty** (77) **knowledge** (78) **goodness** (79) **honesty** (80) **truth**

36 Four of the following words have something in common. Which one is not like the other four?
(81) **cowardly** (82) **dishonest** (83) **poor** (84) **stingy** (85) **rude**

37 A photograph is 3 inches wide and 5 inches long. If it is enlarged to be 12 inches wide, how long will it be?
(1) **8 in.** (2) **20 in.** (3) **14 in.** (4) **15 in.** (5) **60 in.**

38 The opposite of spend is —
(6) **give** (7) **earn** (8) **money** (9) **take** (10) **use**

39 Which of the following sentences tells best what an airplane is?
(11) **It flies.** (12) **It is something to travel in.** (13) **It is a flying conveyance.**
(14) **It has wings and a tail.** (15) **It is a mechanical bird.**

40 A man drove 9 miles east from his home, and then drove 4 miles west. He was then (?) of his home.
(16) **5 miles east** (17) **5 miles west** (18) **13 miles east** (19) **13 miles west**

41 If the following words were rearranged to make the best sentence, with what letter would the *last* word of the sentence begin?
men deep the a trench dug long
(21) **d** (22) **l** (23) **t** (24) **s** (25) **m**

42 A pitcher is to cream as a bowl is to —
(26) **baseball** (27) **a saucer** (28) **coffee** (29) **sugar** (30) **a dish**

43 If the following words were rearranged to make the best sentence, the *last* word of the sentence would begin with what letter?
cook the pie a made apple deep
(31) **c** (32) **p** (33) **a** (34) **d** (35) **m**

44 A very strong feeling of affection is called —
(36) **sympathy** (37) **pity** (38) **admiration** (39) **love** (40) **esteem**

(*Go on to the next page.*)

45 A chair is most likely to have —
(41) **rockers** (42) **upholstery** (43) **legs** (44) **a seat** (45) **arms**

46 A boy has three dogs. Their names are Rover, Spot, and Fido. Rover is larger than Spot and Spot is larger than Fido. Therefore, Rover is (?) Fido.
(46) **smaller than** (47) **larger than** (48) **the same size as** (49) ***cannot say which***

47 Wood is to box as wire is to —
(51) **iron** (52) **electricity** (53) **doorbell** (54) **screen** (55) **fire**

48 There is a saying, "It is a long road that has no turning." It means —
(56) **Most long roads are straight.** (57) **Things are bound to change sooner or later.**
(58) **Most short roads have turns.** (59) **It is a bad idea to turn around on the road...**

49 Which of the five things below is most like a sheet, a towel, and a handkerchief?
(61) **a blanket** (62) **a coat** (63) **a napkin** (64) **a carpet** (65) **a mattress**

50 Three of the four designs at the right are alike in some way. Which one is not like the other three? (66)  (67)  (68)  (69) 

51 If the following were arranged in order, which one would be in the middle?
(71) **foundation** (72) **walls** (73) **ceiling** (74) **roof** (75) **floor**

52 Which one of these series contains a wrong number?
(1) **2–4–6–8–10** (2) **1–3–5–7–9** (3) **3–6–9–12–15** (4) **1–4–7–10–12**
(5) **2–5–8–11–14**

53 A pair of trousers always has —
(6) **a belt** (7) **cuffs** (8) **pockets** (9) **a crease** (10) **seams**

54 One number is wrong in the following series. What should that number be?
8 1 8 2 8 3 8 4 8 5 8 6 8 7 8 9
(11) **9** (12) **7** (13) **6** (14) **8** (15) **5**

55 A machine that works rapidly and well is said to be —
(16) **fluent** (17) **revolutionary** (18) **novel** (19) **automatic** (20) **efficient**

56 What letter in the following series appears a third time nearest the beginning?
A C E B D D E A B C B E C A D A B C D E
(21) **A** (22) **C** (23) **D** (24) **E** (25) **B**

57 The stomach is to food as the heart is to —
(26) **a man** (27) **the lungs** (28) **blood** (29) **a pump** (30) **beating**

58 In the alphabet, which letter follows the letter that comes next after Q?
(31) **O** (32) **S** (33) **P** (34) **T** (35) **R**

59 Most persons prefer automobiles to buses because —
(36) **it is always cheaper to use an automobile.** (37) **the bus carries too many persons.**
(38) **an automobile gets you where you want to go when you want to go.**
(39) **automobiles are easier to park.**

60 The opposite of contract is —
(41) **explode** (42) **detract** (43) **expend** (44) **die** (45) **expand**

61 In a certain row of trees one tree is the fifth one from either end of the row. How many trees are there in the row?
(46) **5** (47) **8** (48) **10** (49) **9** (50) **11**

62 There is a saying, "Honesty is the best policy." It means —
(51) **Honesty is more important than generosity.**
(52) **In the long run it pays to be honest.** (53) **Honest people become wealthy.**
(54) **You can never tell what a dishonest person will do.**

63 Three of the four designs at the right are alike in some way. Which one is not like the other three? (56)  (57)  (58)  (59) 

(*Go on to the next page.*)

OCCUPATIONAL INTEREST INVENTORY — Advanced, Form A

Devised by Edwin A. Lee and Louis P. Thorpe

Name..... Occupation or Grade.....

Date..... Age..... Birthday..... Sex: M-F

Instructor or Examiner..... Business or Institution.....

City..... 1. .....

2. ..... 3. .....

FIELDS OF INTERESTS	Score	Percentile Rank	PERCENTILE (Chart percentile rank here) L | L-Av | H-Av | H; 1 10 20 30 40 50 60 70 80 90 99
A. P-S.	____	____	
B. Nat.	____	____	
C. Mech.	____	____	
D. Bus.	____	____	
E. Ar.	____	____	
F. Sci.	____	____	
TYPES OF INTERESTS			
1. Verb. . . . . (1)	____	____	
2. Manip. . . . . (2)	____	____	
3. Comp. . . . . (3)	____	____	
LEVEL OF INTERESTS			
a____ + d____ = ____ x 1 = ____			
b____ + e____ = ____ x 2 = ____	____	____	
c____ + f____ = ____ x 3 = ____			1 10 20 30 40 50 60 70 80 90 99 L | L-Av | H-Av | H

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ANALYSIS OF OCCUPATIONAL CHOICES FOR SPECIFIC INTEREST AREAS

The following analysis of occupational choices will enable each person to determine more specific areas or "families" of occupational interests than is shown in the six major fields of interests. This analysis conforms, in general, to that given on page 3 of the Manual of Directions.

It is suggested that the counselor, or the individual concerned, may check on this Analysis the responses which are shown on the inventory booklet as follows: **Encircle the numbers for the various letter classifications (A, B, C, etc.) to show a more specific indication of fields of interest in the major occupational areas.**

Ordinarily, it is sufficient to check only those fields which are found to be above the 50 percentile on the chart. If time permits, however, there is some advantage in self-appraisal and counseling to check all the Fields to show possible specific areas in those fields of occupation which are avoided.

(NOTE: Those specific occupational families for which there are three or more descriptions are included in this classification. The outline accounts for approximately 200 of the 240 descriptions included in the Inventory.)

A. PERSONAL-SOCIAL:	1.	Domestic Service	2, 7, 38, 106
	2.	Personal Service	10, 22, 39, 62, 98, 107, 110, 118
	3.	Social Service	24, 47, 52, 53, 69
	4.	Teaching	1, 27, 40, 57, 64, 80, 105, 111
	5.	Law and Law Enforcement	4, 11, 17, 54, 112
	6.	Health and Medical Service	33, 45, 60, 84, 93, 100, 113
B. NATURAL:	1.	Farming and Ranching	31, 43, 55, 58, 66, 78, 94, 103
	2.	Raising and Caring for Animals	4, 44, 49, 86, 87, 118
	3.	Gardening and Greenhouse Care	15, 54, 68, 81, 91, 97, 111
	4.	Fish, Game, and Domestic Fowl	21, 34, 75, 116, 117
	5.	Lumbering and Forestry	56, 57, 61, 90
C. MECHANICAL:	1.	Maintenance	14, 30, 50, 58, 65, 82
	2.	Machine Operation	17, 25, 72, 79, 87
	3.	Repairing	6, 19, 38, 85, 95, 119
	4.	Construction Work	11, 35, 48, 59, 61, 74
	5.	Designing	8, 12, 24, 32, 68, 84
D. BUSINESS:	1.	Clerical	9, 26, 34, 46
	2.	Shipping and Distribution	22, 50, 94, 110, 114
	3.	Bookkeeping and Accounting	3, 15, 21, 23, 27, 29, 72, 75
	4.	Selling and Buying	1, 33, 36, 59, 63, 92
	5.	Training and Supervision	5, 16, 40, 81
	6.	Management and Control	12, 89, 93, 96, 100, 119
E. THE ARTS:	1.	Art Crafts	6, 46, 73, 78, 79
	2.	Painting and Drawing	9, 14, 18, 44, 85, 99, 106
	3.	Decorating and Landscaping	25, 42, 45, 69, 102
	4.	Drama and Radio	19, 39, 63, 97, 112
	5.	Literary Activities	13, 20, 28, 32, 37
	6.	Musical Performance	31, 52, 67, 76, 120
F. THE SCIENCES:	1.	Laboratory Routine	26, 42, 62, 66, 89, 90
	2.	Mineral—Petroleum Prod. Problems	29, 35, 43, 108
	3.	Applied Chemistry	13, 23, 41, 47, 49, 74, 107
	4.	Chemical Research	20, 67, 83, 113
	5.	Biological Research	53, 71, 95, 116
	6.	Scientific Engineering	60, 88, 101, 103, 109, 120

(Note: This analysis originally appeared on page 3 of the Manual of Directions. Among those suggesting that it be prepared as a special analysis form were Dr. Andrew H. McPhail, Chief Examiner, Veterans Guidance Center, Providence, Rhode Island, and Dr. Ida Linnick, Chief Psychologist, Federated Employment Service, New York City.)

PART I.

DIRECTIONS: On this and the following pages you will find brief descriptions of kinds of work or things people do. You are to select the one of each pair that you would prefer if you had to choose one or the other. Do not consider how much you would earn, how much training would be necessary, or what people think of the activity. Assume that you must select one activity or the other even though, in some cases, you may not especially like either one or you may like both. Put a circle around the letter preceding the activity you choose.

Sample: A. Raise chickens, ducks, or turkeys and sell them.
B. Arrange a display of watches, rings, and other jewelry in a store window.

1

A Take care of children and assist in their education. (0-30.11) (0-30.02)

D Buy and sell used cars, radios, or other articles for profit. (1-61.60) (0-74.11) (0-91.80)

2

F Clean and recharge storage batteries. (5-89.411)

A Wash dishes, make beds, iron clothing, or clean floors. (2-03.11) (2-04.01)

3

E Make costumes and settings according to the plans of a designer. (4-25.030) (0-43.50)

D3 Analyze business and financial reports or compare price quotations. (0-28.10) (1-65.01)

4

A Investigate legal problems and interpret the law. (0-22.10)

B Doctor horses, cattle, or hogs. (0-34.10)

5

C Make drawings with a compass, triangle, ruler, or other instruments. (0-48.05) (0-48.040) (0-48.18)

D1 Organize work schedules or train and supervise the work of others. (0-97.12) (0-97.03)

6

C Repair shoes, boots, or slippers. (4-60.100)

E Knit sweaters, socks, or mittens. (4-14.061)*

7

A Manage another person's house. (2-03.01)

C2 Bake bread, rolls, pies, or cakes. (4-01.100)

8

B Diagnose tree diseases and do tree surgery. (0-68.13)

C2 Design and build radio or television equipment. (0-17.01)

9

D3 Classify orders, figure price quotations, and make out price sheets (1-01.35)

E Draw cartoons, comics, or caricatures of people. (0-01.41)

10

E Take and sell snapshots of people on the streets or in places of amusement. (0-56.45)*

A Do hair-cutting, hair dressing, manicuring, or shampooing. (2-32.15)

11

C2 Make model houses, boats, airplanes, or toys. (5-13.011)

A Investigate and solve crimes and report or testify concerning findings. (2-65.01)

12

D Manage or direct a large store or a division of a corporation. (0-97.14)

C2 Invent new machinery or equipment. (0-19.01) (0-18.01)

13

E1 Write dialogue or commercial announcements for radio programs. (0-06.24)*

F Find substitutes for metal, rubber, wood, and other materials. (0-07.03)

14

E Copy sketches of people, animals, or buildings. (0-04.01)* (0-44.21) (0-44.31)

C2 Wash and grease trucks or automobiles. (7-85.010)

15

D3 Prepare payrolls, figure salesmen's commissions, and make salary deductions. (1-26.01)* (1-26.02)*

B Cultivate and care for vegetables, flowers, or other garden products. (3-09.10) (3-38.10)

16

D Supervise the selection, placement, and promotion of employees.
(0-68.71)

E Design plans for houses, public buildings, and apartments.
(0-03.10)

17

A Enforce laws and protect life and property.
(2-66.23)

C[2] Operate drill presses, lathes, planers, or milling machines.
(4-75.010)

18

E[2] Copy posters, signs, or campaign slogans.
(5-27.910)

B Dig coal, iron, or other minerals from the earth.
(5-21)

19

E[1] Impersonate the speech and manners of well-known people to entertain others.
(0-02.21)*

C Repair clocks, radios, or speedometers.
(4-71.510) (5-83.411)

20

E[1] Write descriptions or criticisms of paintings, architectural designs, or sculpture.
(0-06.44)

F Plan and direct chemical experiments to produce or improve materials.
(0-07.03)

21

B Raise chickens, turkeys, or other poultry.
(3-08.10)

D[3] Make bookkeeping entries, take off trial balances, or keep inventory records.
(1-01.02)

22

D[2] Assemble and wrap merchandise for shipping to customers.
(1-34.14)*

A Go on errands, deliver messages, or help people with their baggage.
(2-23.14) (2-22.11)

23

F Change raw materials to useful products.
(8-98.01)* (8-57.01)* (8-36.01)*

D[3] Prepare monthly statements, balance sheets, or statements of profit and loss.
(1-01.02) (1-02.01)

24

A[1] Assist people in right living and in solving their personal problems.
(0-08.10) (0-27.01) (0-39.17)

C Invent or design tools for the manufacture of accurate machinery.
(0-19.01)

25

C Operate a printing press or power sewing machine.
(4-44.010) (6-27.524)*

E[2] Arrange color harmonies, furniture combinations, hangings, and decorations in a home.
(0-43.40)

26

F[3] Keep records, under another's direction, of scientific experiments.
(0-50.23)

D Address envelopes or fold letters and circulars for mailing.
(1-18.01)* (1-37.32)

27

D[3] Check credit accounts or invoices and discounts.
(0-01.60) (1-01.31)

A Teach basketry, rug-making, and other handicrafts to handicapped persons.
(0-32.04)

28

E[1] Talk and write about the merits of concerts, radio programs, and operas.
(0-06.44)

C Adapt plastic materials to replace articles made of metal, wood, or rubber.
(0-46.88)

29

D[3] Receive bank deposits, cash checks, or make entries regarding savings and commercial accounts.
(1-06.02)

F Try out new methods of drilling, refining, or storing oil.
(0-20.11)

30

F[3] Keep records of rainfall, temperature, or humidity.
(0-39.51)

C Clean and oil electric motors, sewing machines, or bicycles.
(9-00.91)* (8-94.43)*

31

E Play an instrument in a band, orchestra, or other musical organization.
(0-24.12)

B² Plant, cultivate, and harvest crops with power machinery.
(3-06.10)

32

C Design or improve specialized machinery such as motion picture cameras or telescopes.
(0-19.01)

E¹ Write short stories, feature articles, or special reports for newspapers or magazines.
(0-06.44) (0-06.04)*

33

A Test eyes and prescribe glasses.
(0-53.10)

D³ Prepare cashier's checks, receive payments on loans, and sell bonds to customers.
(1-18.81)*

34

D Type letters, orders, or financial statements.
(1-37.32) (1-37.34)

B Catch fish for a living.
(3-87)

35

F Examine the formation of mineral deposits and determine how they may be extracted.
(0-20.01)

C Lay hardwood floors, frame pictures, or hang doors.
(5-25.10) (6-38.282)

36

D Do the buying for a large store or chain of stores.
(0-74.11)

F³ Develop new mathematical formulas and short-cuts for use in research.
(0-28.10)

37

B Clear land of stumps and brush by use of machinery.
(7-36.510)*

E¹ Report news and write short articles for a newspaper.
(0-06.71)

38

A• Wait on other people in their homes and help them with the housework.
(2-03.01)

C Patch or vulcanize tubes and replace tubes and tires on wheels.
(7-60.500)

39

E Dance alone or with a partner in plays or at entertainments.
(0-45.11)

A¹ Take care of the correspondence and private affairs of another person.
(1-33.02)

40

A¹ Help students with their learning difficulties and in acquiring knowledge.
(0-11.50) (0-31.01) (0-30.11) (0-32.20)

D Direct the sales policies for a large firm and manage a group of salesmen.
(0-97.61)* (0-19.04)

41

C² Paint signs on windows or do lettering on posters with a brush or pen.
(5-27.910)

F Combine drugs to make medicines or fill prescriptions.
(0-25.10)

42

F Wash test tubes, fill bottles, or paste labels.
(9-64.38)*

E² Construct and plant rock gardens or make flower beds.
(3-40.06)

43

F³ Analyze and determine the value of gold, silver, and other valuable ores.
((0-39.45) (0-07.21)

B Operate a farm tractor, planter, or harvester.
(3-06.10) (3-11)

44

B Breed pedigreed dogs, thoroughbred horses, or other animals.
(3-07.10) (0-68.01)

E² Paint pictures of landscapes, scenes, or flowers for exhibition and sale.
(0-04.01)*

45

A² Take temperatures, give blood tests, and administer hypodermics.
(0-33.10)

E Plan the arrangement of trees, shrubbery, flowers, and lawns.
(0-02.30)

46

E Make articles from beads, raffia, or leather.
(0-32.04) (6-62.020)

D File letters, bills, or reports, and look up information in files.
(1-17.01)

47

F Experiment with new processes for the harmless and permanent dyeing of cloth and other materials.
(5-57.410)

A1 Visit homes to help people with their difficulties.
(0-27.01)

48

C Plan or supervise the construction of a building or a bridge.
(0-16.01)

F3 Develop methods of long-range weather forecasting or prediction.
(0-39.51)

49

B Raise cattle, sheep, or hogs for the market.
(3-07.10)

F Determine the ingredients in perfumes and improve their quality.
(0-07.21)

50

D2 Unpack goods, keep a storeroom in order, or restock shelves.
(1-38.01)

C Repair or patch roads and highways.
(9-32.31)*

51

B Boss a group doing farm work.
(3-37.20)*

A1 Make appointments and give information to the public.
(1-18.41) (1-18.42)

52

A1 Advise older students in making important life decisions.
(0-39.84)

E Compose music, or make musical arrangements for orchestras, bands, or choruses.
(0-24.42)*

53

A1 Listen to people's problems and try to help them.
(0-39.17) (0-27.01)

F Breed animals or birds to improve the quality of the stock.
(0-68.01) (3-08.10)

54

B2 Grade, sort, or pack fruit or vegetables.
(3-15.22)*

A Guard property or help children to cross streets.
(2-66.23)

55

C Engrave on metal; or cut, polish, and set precious stones.
(4-73.510) (4-71.010)

B Have responsibility for the care of farm and ranch equipment.
(3-35.10)

56

B Direct the care and protection of large forests.
(0-38.01)

F3 Use telescopes and mathematical formulas to discover new facts.
(0-39.47)*

57

A Supervise the activities of children on playgrounds or in camps.
(0-27.15)

B Be a foreman in a lumber mill.
(5-91.411)*

58

C2 Do odd jobs with a saw, hammer, or plane.
(5-25.01)

B Pick cotton, tomatoes, or fruit.
(3-13.92)*

59

D1 Explain the merits of new products and persuade people to buy them.
(1-80.01) (1-55.10)

C Plaster walls, build fire-places, or lay bricks.
(5-29.100) (5-24.010)

60

A2 Care for and repair people's teeth.
(0-13.10) (0-50.07)

F Use the known properties of air, water, earth, and electricity to improve the transmission of sound.
(0-39.48) (0-17.01)

61

C Weld or rivet bridges, buildings, or ships.
(4-85.030) (4-85.020)

B Keep a lookout for forest fires and protect forest telephone lines.
(0-68.18) (0-68.17)

62

A Carry trays, clean utensils, and assist nurses in caring for patients.
(2-42.20) (2-42.10)

F Sterilize instruments, equipment, or dressings.
(1-32.20)

63

D[1] Solicit contributions to worthy causes on a salary or commission basis.
(0-83.10) (1-15.02)

E Perform acrobatic stunts, do comedy parts in plays, or tell jokes to entertain people.
(0-02.11) (0-02.15) (0-02.21)*

64

B Manage the employes and equipment on a large farm or ranch.
(3-37.10)

A[1] Help young children to learn and to develop good attitudes and habits.
(0-32.98) (0-30.02) (0-30.11)

65

D Keep a record of goods received, on hand or sold.
(1-38.01) (1-01.02)

C Paint, varnish, or stain wood or metal surfaces.
(5-27.010)

66

B Harvest wheat, beans, or rice.
(3-03.10)

F Repair laboratory equipment or sterilize instruments.
(1-32.20) (0-50.21)*

67

E Train others how to sing, play instruments, or perform in public.
(0-24.31) (0-45.51)

F Operate a laboratory for testing new drugs or chemicals.
(0-07.02) (0-07.03)

68

C Devise methods of determining the accuracy and strength of steel or concrete work.
(0-19.01)

B Experiment with fertilizers or chemicals to increase plant production.
(0-39.54)

69

A[1] Investigate the facts about people's occupations, income, and general success.
(0-39.14)

E Arrange clothes, shoes, jewelry, or other merchandise for displays.
(0-43.30)

70

D[1] Answer and give information over the telephone, and work at a switchboard.
(1-41.12)

E Help a vaudeville performer, work in a circus crew, or make stage arrangements.
(5-56.540)*

71

F Try out foods, diets, and vitamin combinations to solve nutrition problems.
(0-39.93)

E[1] Appear before an audience as a lecturer or actor.
(0-39.91)* (0-02.11)

72

C Organize and supervise a group of men or women who are operating complicated machines.
(5-91.201)

D[3] Check the accuracy of financial records of banks or corporations.
(0-01.60) (0-01.20)

73

F Operate X-ray machines or other laboratory apparatus.
(0-50.04)

E Mold vases, statues, or other decorative figures from clay.
(6-66.453)

74

C Pour cement, lay railroad ties, or carry plaster or bricks.
(9-32.41)* (9-32.21)*

F[2] Test milk, butter, cheese, and other dairy products.
(3-48)*

75

B Guard the safety and feeding of wild life.
(0-94.94)

D[3] Operate a bookkeeping system or figure the costs of specific jobs.
(1-02.01) (1-01.35)

76

E Conduct a band, orchestra, or chorus.
(0-24.12)

D[3] Have charge of accounts, collections, and credits in a large mercantile company.
(0-85.10)*

77

C Hang paper, decorate walls, or carry out interior color schemes.
(5-28.100) (5-27.010)

A[1] Meet clients or patients, make appointments, and do general office work.
(1-18.41)

78

B[2] Mend fences, tend live stock, or repair equipment on another person's farm or ranch.
(3-11)

E Make handkerchiefs, neckties, or scarfs.
(6-27.082)*

79

C[2] Operate a weaving or knitting machine, or make cotton or woolen goods.
(4-14.061)*

E Carve animals or ornamental figures out of wood or plastics.
(4-33.361)

80

F Design experiments to test the uses and limitation of new drugs and chemicals.
(0-07.03) (0-07.21)

A[1] Give talks and lectures for the purpose of influencing large groups.
(0-83.10)

81

D Supervise the employees in a small printing plant, machine shop, or factory.
(5-91.701)* (5-92.768)*

B[2] Raise bulbs, plants, and seeds for market.
(3-38.10) (3-38.20)

82

C Wax floors, wash windows, or dust woodwork.
(2-03.11) (2-04.01)

D[2] Arrange displays of foodstuffs or merchandise in show cases or on shelves.
(0-43.30)

83

D[3] Invest money, make out budgets, or manage money matters for others.
(0-91.80)

F Try out new materials for making artificial teeth, bridges, or inlays.
(0-50.06)

84

C Design or supervise the construction of automobiles, ships, or airplanes.
(0-19.01) (0-03.30) (0-19.03) (0-46.88)

A[2] Treat wounds, perform surgical operations, and help sick people to get well.
(0-26.10)

85

E Make drawings of clothing, furniture, or other merchandise for advertising purposes.
(0-44.21)

C Install water pipes, repair plumbing, or fix furnaces and heating systems.
(5-30.210)

86

B Feed and care for livestock.
(3-07.10) (3-11)

C[2] Label bottles, sort and wrap fruit, or pack eggs.
(7-68.214)* (3-30.02)*

87

B Trap or raise fur-bearing animals.
(3-97.30)*

C Copy or cut patterns in wood, metal, or plastics.
(5-17.020) (5-17.010)

88

F Design mechanical models or machines for scientific purposes.
(0-19.01) (0-19.02)

D[3] Analyze business trends, operating expenses, and various business costs.
(0-28.10) (0-28.30)

89

F Keep records regarding animals or insects to learn more about their behavior.
(0-39.31) (3-48.92)

D Manage an athletic team, musical organization, or show.
(0-57.51)*

90

F[2] Keep a doctor's tools and equipment in good order.
(1-32.20)

B Cut down trees and make them into firewood.
(6-30.130)*

91

B Graft and prune trees or plants.
(0-40.13) (0-68.13)

E Design ready-made suits, dresses, or hats.
(0-46.01) (4-23.100)

92

B Develop better methods of producing and marketing farm products.
(3-37.10) (0-12.20) (1-52.21)

D Plan advertising campaigns, and develop new ideas for selling goods.
(0-81.04)

93

D Manage an apartment building, cafeteria, or grocery store.
(0-87.10)* (0-71.21)* (0-72.21)*

A Aid health authorities in combating disease and epidemics.
(0-33.10) (0-27.01)

94

B Milk cows and operate cream separators.
(3-04.10) (3-11)

D Wrap bundles or packages for customers.
(9-59.91)*

95

F Study the internal structures and body processes of insects or worms.
(0-39.31)

C Install electric wiring in buildings, rewind electric motors, or repair electric household fixtures.
(5-83.433) (5-83.041) (4-97.010)

96

D Manage or direct the operations of a bank, investment house, or stock exchange.
(0-98.08)* (0-98.13)*

B Develop and apply theories and principles of mining.
(0-20.01)

97

E Make announcements or read news reports before a microphone.
(0-69.21)

B Plant and raise large quantities of vegetables on a commercial basis.
(3-09.10)

98

A Wait on tables and help with meals away from home.
(2-03.11)

C Transport passengers or materials on an elevator.
(2-95.20) (2-95.30)*

99

E Teach drawing or painting.
(0-04.51)

D Operate a comptometer, calculator, or adding machine.
(1-25)

100

D Manage or direct a manufacturing corporation, a shipbuilding yard, or an oil company.
(0-97.41)*

A Determine why people are mentally ill and recommend treatment.
(0-26.10) (0-39.17)

101

F Apply scientific principles to the improvement of radio and other sound equipment.
(0-17.01) (0-39.48)

C Make clothes, do accurate sewing, or fit clothes on forms.
(4-25.030)

102

E Mow lawns, clip hedges and bushes, and trim trees.
(3-40.01)

F Keep a chemical store-room or physical laboratory in order.
(0-50.21)* (1-38.01)

103

B Have charge of the cultivation and irrigation of crops on large farms.
(3-37.10)

F Construct laboratory apparatus and science equipment.
(4-65.440) (5-00.912)

104

E Design the settings and costumes for plays or movies.
(0-46.32) (0-46.05)

B Plan experiments to control worms, insects, and other pests.
(0-39.35) (1-68.11)

105

E Teach people how to improve their manners and poise.
(0-02.41)* (0-11.50)

A Advise parents regarding the proper rearing of children.
(0-39.17)

(A____ B____ C____ D____ E____ F____)

106

A Shine people's shoes and brush their clothes.
(2-34.10)*

E Paint and decorate unfinished furniture.
(5-16.720)*

107

A Help people to be comfortable and well when they travel.
(2-91.10)*

F Develop new toothpastes, cosmetics, or shaving creams.
(0-50.23)

108

F Develop new methods of locating minerals and oil.
(0-39.45)

C Experiment with the making of synthetic products, such as artificial teeth, nylon, or cellophane.
(0-07.21) (0-07.03)

109

F Test new labor-saving machinery and devices.
(0-18.01)

B Direct the quick-freezing or de-hydration of farm products.
(5-91.099)*

110

A Deliver groceries, milk, or drugs to customers.
(7-35.100)

D Put tags and labels on merchandise, make out shipping bills, or help take inventories.
(1-34.14)* (1-38.01)

111

A Teach other people how to play golf, tennis, baseball, or other sports.
(0-57.21)

B Plant and care for trees, shrubs, or lawns.
(3-40.01) (0-39.62)

112

E Plan and direct a play or motion picture.
(0-02.35)*

A Organize and direct groups who are defending their country at home or abroad.
(0-97.14) (0-27.11)*

113

F Select the proper chemicals to remove spots from clothing and to clean dresses economically.
(5-57.310)* (5-57.110)

A Assist a dentist in caring for people's mouths and teeth.
(0-50.07) (1-32.10)*

114

D Deliver packages, carry messages, or run errands for a business concern.
(1-23.14)

F Maintain constant temperature and humidity in a hot-house.
(3-39.10)* (3-38.20)

115

B Determine the grade and quality of different kinds of fruit.
(3-05.01) (3-11)

C Make or remodel women's hats.
(4-23.100)

116

F Experiment with living plants and flowers to explore the laws of growth.
(0-39.35)

B Manage fish hatcheries or game preserves.
(0-68.07) (0-94.94)

117

B Raise fish or frogs in private ponds for the market.
(3-07.60)*

A Select people qualified for jobs in business and industry.
(0-68.71) (1-18.31)

118

A Show people to seats at theaters, games, or entertainments.
(2-48.10)

B Herd cattle or sheep on the range.
(3-17.20) (3-07.10)

119

C Upholster or repair furniture.
(4-35.710) (4-35.720)

D Operate a laundry, dry cleaning concern, or shoe repairing business.
(5-57.110) (4-60.100)

120

F Apply scientific principles to the development of new instruments and machines.
(0-19.01)

E Give public performances on the piano, violin, or other instrument, or appear as a vocal soloist.
(2-24.12)

A____ B____ C____ D____ E____ F____

PART II.

DIRECTIONS: Below you will find three activities under each number. You are to choose one of the three in each group. Indicate your choice by a circle around the letter preceding the activity.

1

b. Take temperatures, give blood tests, and administer hypodermics.
c. Treat wounds, perform surgical operations, and help sick people to get well.
a. Do hair-cutting, hair-dressing, manicuring, or shampooing.

2

d. Cut down trees and make them into firewood.
e. Graft and prune trees or plants.
c. Diagnose tree diseases and do tree surgery.

3

f. Design and build radio or television equipment.
d. Clean and oil electric motors, sewing machines, or bicycles.
b. Repair clocks, radios, or speedometers.

4

a. Type letters, orders, or financial statements.
f. Check the accuracy of financial records of banks and corporations.
b. Make bookkeeping entries, take off trial balances, or keep inventory records.

5

f. Be the leader of a band or orchestra, or direct a group of musicians while playing.
e. Play an instrument in a band, orchestra, or other musical organization.
a. Sing in a chorus, choir, or other vocal organization.

6

b. Operate X-ray machines or other laboratory apparatus.
d. Keep a doctor's tools and equipment in good order.
f. Plan and direct chemical experiments to produce or improve materials.

7

e. Take care of the correspondence and private affairs of another person.
f. Assist people in right living and in solving their personal problems.
d. Go on errands, deliver messages, or help people with their baggage.

8

a. Catch fish for a living.
b. Guard the safety and feeding of wild life.
f. Manage fish hatcheries or game preserves.

9

c. Invent or design tools for the manufacture of accurate machinery.
a. Do odd jobs with a saw, hammer, or plane.
e. Make model houses, boats, airplanes, or toys.

10

a. File letters, bills, or reports and look up information in files.
c. Manage or direct the operation of a bank, investment house, or stock exchange.
e. Prepare cashier's checks, receive payments on loans, or sell bonds to customers.

11

f. Paint pictures of landscapes, scenes, or flowers for exhibition and sale.
b. Show others how to make better drawings or paintings.
d. Copy sketches of people, animals, or buildings.

12

a. Keep records, under another's direction, of scientific experiments.
e. Operate a laboratory for testing new drugs and chemicals.
c. Use telescopes and mathematical formulas to discover new facts.

13

e. Observe and keep records regarding animals or insects to learn more about their behavior.
c. Plan experiments to test the effectiveness of pest control methods.
d. Wash test tubes, fill bottles, or paste labels.

14

a. Mend fences, tend livestock, and repair equipment on another person's farm or ranch.
e. Clear land of stumps and brush with machinery.
c. Manage the employees and equipment on a large farm or ranch.

a____ b____ c____ d____ e____ f____)

15

c. Plan and supervise the construction of a building or a bridge.
d. Pour cement, lay railroad ties, or carry plaster or bricks.
e. Weld or rivet bridges, buildings, or ships.

16

d. Unpack goods, keep a storehouse in order, or restock shelves.
f. Supervise the selection, placement, and promotion of employees.
b. Organize work schedules or train and supervise the work of others.

17

c. Design the settings and costumes for plays or movies.
b. Arrange color harmonies, furniture combinations, hangings, and decorations in a home.
a. Mow lawns, clip hedges, and bushes, and trim trees.

18

e. Study the internal structure and body processes of insects or worms.
a. Maintain constant temperature and humidity in a hot-house.
c. Experiment with living plants and flowers to explore laws of growth.

19

b. Advise parents regarding the proper rearing of children.
f. Advise older students in making important life decisions.
d. Wait on other people in their homes, and help them with the housework.

20

a. Dig coal, iron, or other minerals from the earth.
b. Be in charge of running a coal or iron mine.
c. Develop and apply theories and principles of mining.

21

c. Invent new machinery or equipment.
d. Patch or vulcanize tubes and replace tubes and tires on wheels.
b. Operate drill presses, lathes, planers, or milling machines.

22

d. Feed and care for livestock.
f. Doctor horses, cattle, or hogs.
e. Raise cattle, sheep, or hogs for the market.

23

f. Develop new ideas for drawings, paintings, or color design.
e. Draw cartons, comics, or caricatures of people.
d. Copy posters, signs, or campaign slogans.

24

b. Enforce laws and protect life and property.
d. Guard property or help children to cross streets.
c. Investigate legal problems and interpret the law.

25

e. Investigate the facts and report on the foods that people eat.
c. Manage a large hotel or chain of hotels.
a. Wait on tables and help with meals away from home.

26

a. Wrap bundles or packages for customers.
b. Explain the merits of new products and persuade people to buy them.
f. Direct the sales policies for a large firm and manage a group of salesmen.

27

c. Adapt plastic materials to replace articles made of metal, wood, or rubber.
d. Wash and grease trucks or automobiles.
b. Copy or cut patterns in wood, metal, or plastics.

28

a. Arrange displays of foodstuffs or merchandise in show cases or on shelves.
f. Do the buying for a large store or chain of stores.
e. Keep a record of goods received, on hand, or sold.

29

f. Give lectures on technical subjects or make public speeches.
b. Make announcements, or read news reports before a microphone.
a. Announce the arrival and departure of trains or busses.

30

b. Apply scientific principles to the improvement of radio and other sound equipment.
d. Clean and recharge storage batteries.
f. Design mechanical models or machines for scientific purposes.

a____ b____ c____ d____ e____ f____)

3